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INDEX TO CONTENTS, PAGE 33. - - - - - - - - - ADVERTISERS' INDEX, PAGE 22.

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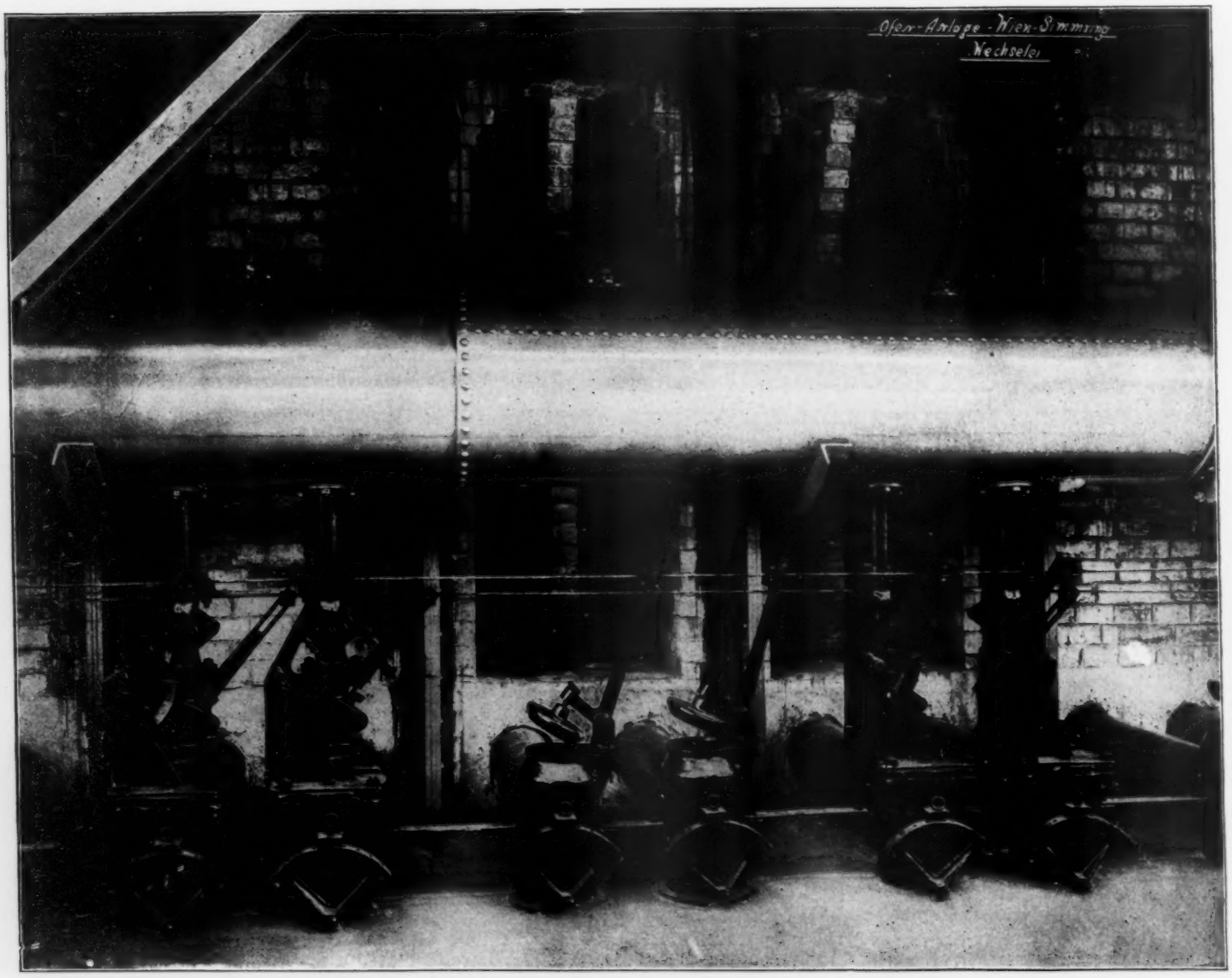

KOPPERS REGENERATORS—GAS PLANT AT VIENNA.

H. KOPPERS COMPANY,

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5 S. Wabash Avenue, - - - CHICAGO, ILLINOIS.

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CONTENTS.

An Asterisk (*) Denotes an Illustrated Article.

The Key West (Fla.) Gas Plant, by "G." 33

Proceedings, Eighth Annual Meeting, Illinois Gas Association—
Continued from Page 19 34
Third Day, Morning Session—*Liquid Purification of Illuminating Gas, by Mr. C. A. Schnerr.

Proceedings, Fourth Annual Meeting, Southern Gas Association—
Continued from Page 30 42
Second Day, Morning Session—Meter and Meter Repairs, by Mr. Chas. Leech—Discussion.

OFFICIAL NOTICE—
Transportation Announcement Respecting the Coming Meeting, American Gas Institute 40

EDITORIALS—
Briefly Told 40
Gas Pressure Regulation for the Borough of Manhattan—U. S. Government Hearing on Flange Fittings—First Annual Meeting of the "Gas Meeters"—Report of Massachusetts Board of Gas and Electric Light Commissioners—Current Mention.

Opportunities of the Clerk, by Mr. H. S. Dutton 45

MANAGEMENT AND COMMERCIAL METHODS 45
*The Ugite Spreader Truck—*The May Queen at a California Outing.

Recent Patent Issues 46

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 46
Contract for the Lloyd Construction Company—Wedding Bells—Improving the West Point (N. Y.) Gas Plant—Death of Mr. Nelson A. Greene—Death of Gen. W. P. Orr—The United Gas and Electric Corporation—Proposing Opposition for Monmouth, Ills.—Will Detroit Change Its Ways?—The Gas Supply for Excelsior, Minn., to be Maintained—The Hackettstown (N. J.) Charter Not Upheld—Anent the Public Lighting of Boston, Mass.—The American Utilities Company—Mr. Lanphier Named Inspector—New Construction, Minneapolis, Minn.—Mr. J. S. Small Buys in at Ottawa, Kas.—Personal—And Other Items.

Public Lighting Table for July, 1912 47

The Market for Gas Securities 48

Meeting Times of the Various Gas Associations 48

The Key West (Fla.) Gas Plant.

[Prepared for the JOURNAL by "G."]

Key West is a long way from Philadelphia and New York, but the distance did not prevent a gas plant from being put in on the southernmost city of the United States. Mr. J. Alex. Mayers, of New York, came down here as Chief Engineer, and put up a ½-million dollar plant in 7 months. Not only did he increase his reputation by so doing, but further added to his glory by incidentally hooking one of the largest tarpon caught in "Jack Channel" this season.

Coming here alone, we had to pick up local labor for most of our work; and we had the worst of the "Bowery" to pick from. The Florida East Coast Railway, which has just completed the great over-sea railroad, turned loose hundreds of hobos, and they were our diggers and pipe layers, until we were able to employ men of a better class of artisans. Not a man of them on the job at first had had any gas experience, so every one of them had to be taught.

We used Universal pipe for our mains, and easily broke in some pipe layers. At first our troubles in getting tight joints were exceedingly many and great. We tested our mains to 20 pounds air pressure for 3 hours, although we were going to finally put on only 3 inches water pressure. The pipe layers became careless to the point of letting sand get into the graphite we used for a lubricant on the joints, and that caused most of our troubles. Returning to the use of white lead instead of graphite, we haven't had any difficulty since in getting our lines tight.

The coral sand particles here being round and smooth, are not easily detected in graphite. Pulverized when the rock is blasted, the coral shatters into very small, fine particles.

Blasting, of course, was a regular procedure. At times we shot as much as 100 pounds of dynamite in a single day. The whole island of Key West is rock, except where intervening openings were filled in by the silt, and there the water soaks in from the Atlantic Ocean and the Gulf Stream. At times a hard layer of rock of a flinty nature was struck, which defied all effort of picking, making the pick rebound a foot or more. We used churn drills to get through the rock and to make our holes for placing the dynamite; as many as 22 men have been counted by the writer, as they stood 2 feet from one another, working their drills preparatory to blasting.

Where we didn't have rock we had water and quicksand. It surely is a queer thing that a coral rock island should have quicksand, but we had to blast and sheet pile in spaces some 800 feet apart. With such a diversity of conditions our unskilled laborers had quite a bit of trouble, and it was no uncommon thing to catch an excited workman putting water out of the ditch into a hollow in the stretch which drained back into the ditch 10 feet away; but, with all these, and a great many more troubles, we succeeded in laying over 25 miles of mains of all sizes. We have a 12-inch feed from the works tying in with a 10-inch belt line on one side and an 8-inch on the other, hooking them together with a 6-inch line in two places, with a 10-inch at another.

The plant proper is as up-to-date as our mains' system. The holders were built by the Cruse-Kemper Company, of Ambler, Pa. The relief holder has a capacity of 50,000 cubic feet, and the storage holder retains 200,000 cubic feet. The same contracting company erected a 200,000-gallon steel oil tank.

The gas machinery (pumps, engines, etc.) were installed by the Gas Machinery Company of Cleveland, Ohio. We have 2 100-horse power, Casey-Hedges, horizontal boilers, a 6-foot 6-inch machine, Cochrane water heater, Sturtevant blower (run by a Skinner self-oiling, high speed engine) which works like a charm, a Root's exhauster, Craig-Ridgway steam hydraulic elevator, oil pump, tar pumps, water pumps, circulating pumps, P. and A. Tar extractor, rotary meter, Connelly balance governor and all other modern conveniences.

Our building is of reinforced concrete and built by the Hennebique Construction Company, of New York. It is well built, being practically a monolith. The building is large enough to allow for future extensions, which extensions are bound to come soon.

All our iron work and buildings are painted with white lead as an outer coat, and the tall 83-feet, Weber, reinforced-concrete stack stands out, not as an eyesore, as many gas plants do, but as a credit to the city. The cornice of our building, in fact, has been awarded much praise, and the whole thing is far from being inartistic.

We began making gas toward the close of June, and from the very first met with a great deal of success. Our machinery worked perfectly, without a hitch, and the holders went up evenly and smoothly, while many watched the unfamiliar sight. Prior to the 4th of July the purging was finished and, at time of writing, we are going "to connect" the Mayor of the city to our mains. It was our privilege to have him make the first 3 runs on our machine, this being the first carburetted water gas made in the City of Key West. It is only right to let him use what he made, and if he is a poor gas maker he will have to suffer for it.

On the eve of turning gas into the stoves of our consumers we have a very bright prospect before us. Already, and almost unsolicited, we have applications for stoves amounting to over 1900. These stoves

we are distributing like meters, they remaining the property of the Company. The applications keep coming in every day. Over 800 are set up and ready for gas, and we are hustling them in as fast as we can. There are in our files about 2,500 applications for gas service pipe at the present moment, and we have over 2,100 of these laid. The gas situation here is a good one, and there is no reason why we should not soon reach the 3,000 consumer mark for a starter. Gas is being sold for $1.60 gross, with a discount of 10 cents per 1,000 for prompt payment.

All our consumers are waiting anxiously for gas. And, why shouldn't they, with wood at $10 a cord, coal at a prohibitive cost, gasoline at 18 cents a gallon and kerosene at 15 cents.

Our telephone is busy with requests to turn on the gas right away, as "We want to put out our gasoline stoves." With a population of about 25,000, and the coming of the Oversea railroad, Key West is bound to grow, and to grow fast; and the Key West Gas Company doesn't intend to be the least of the Island City's boosters.

[CONTINUED FROM page 19.]

PROCEEDINGS OF THE EIGHTH ANNUAL MEETING, ILLINOIS GAS ASSOCIATION.

HELD IN THE AUDITORIUM HOTEL, CHICAGO, MARCH 20 AND 21, 1912.

THIRD DAY—MORNING SESSION.

The President introduced Mr. Clarence A. Schnerr, of Chicago, who read the following paper on the

LIQUID PURIFICATION OF ILLUMINATING GAS.

The need of writing and experimental work along this line is very apparent, for the literature on gas technology is very meager. During recent years improvements in the purification of illuminating gas have been subjects of keen research and of lengthy discussions for many obvious reasons. Dissatisfaction with the use of iron oxide, coupled with the lowering of gas rates, as well as powerful electric competition, has compelled the gas engineer to carefully economize in all parts of the manufacture and distribution of his product.

The matter of distribution has been handled with a fair degree of success, and the various units of the modern gas-producing plant are gradually approaching the lowest production cost; the generating systems are being improved; the boiler and engine rooms are in a satisfactory condition; but we have one exception to this general improvement—the purifying system. It may be asserted, and with perfect truth, that, following the general policy, improvements have been made on the present system, but probably no gas man is willing to express his perfect satisfaction with the present purification. In deed, the general discontent has manifested itself in a constant search for something better. Now, the objects of this paper are:

First. A brief summary of the work done recently on the liquid purification of illuminating gas and the published results.

Second. The results of the experimental work on a system proposed by the writer for the purification of water gas. An examination of the previous work along these lines is quite superficial, no attempts being made to secure the minute technical details; but the various processes have been broadly outlined so that any practical gas man can grasp the underlying principles. This paper is primarily designed to show the development of a new process, and for this purpose ample details will be given.

Purification may be carried on by means of three agents: Solid, liquid or gaseous, or by any combination of the three. Before 1905 practically all elimination of the hydrogen sulphide was effected by means of solid purifying materials. Lime first attained prominence in this direction, but proved such a nuisance that it was finally discarded in the progressive plants. Iron oxide in various forms was then substituted, oxidized borings, bog ore and even precipitated ferric hydrate found favor at various plants. These materials are in use in practically all the gas works of the world at the present time.

Weldon mud (manganese dioxide) and various prepared mixtures were used, but generally with the same results. They all removed hydrogen sulphide, but the use and handling of large masses of solids were entirely unsatisfactory.

Research on purification then turned to some purifying material more easily handled and of greater economic valne, by which is meant cheapness of material, and principally the recovery of the great by-product of hydrogen sulphide extraction—sulphur. When iron oxide is used the recovery is problematical. It has been done, but not extensively. Now, with any ordinary system by which the sulphur is recovered, the purification will practically pay for itself. This may seem visionary to most gas men, but it will give us much pleasure to show how this is done. As a result of these conclusions, the liquids naturally were considered as purifying materials. It is a reflection on the American gas industry, that most of the primary research on this problem has been done by European gas men. At present, however, the matter is being actively considered in this country. Several years ago Walther Feld, a prominent German gas man, became actively engaged on a process, which he later covered with International patents, and pushed it to a successful conclusion. It is being used in England and the United States for the purification of both coal and water gas. The process is, briefly, as follows:

The Feld Liquid Purification System—As originally intended, only the hydrogen sulphide was to have been eliminated, but it was improved later, so it now removes the ammonia and the hydrogen sulphide simultaneously, the active reagents being the sulphate, thiosulphate and thionate of iron. Other salts of a similar nature may be used. The hydrogen sulphide forms an additive compound with the iron salts, which is then broken up by means of sulphur dioxide, forming S and water; the liquor being used repeatedly.

The gas is first scrubbed in a Feld centrifugal washer, with a weak solution of ferrous sulphate, ammonia sulphate being formed and ferrous sulphide precipitating. The liquor from the washer is then treated with sulphur dioxide obtained by burning sulphur in an excess of air. Upon contact, free sulphur is precipitated, and soluble ferrous sulphate, thiosulphate and thionate formed. The liquor so generated is again used for treating the crude gas, but, on account of the thionate and thionsulphate in the liquor, only that portion of hydrogen sulphide corresponding to the ammonia, or about one-half of the total hydrogen sulphide, is eliminated.

The liquor is treated alternately with crude gas and sulphur dioxide until it contains from 30 per cent. to 45 per cent. of ammonia salts. It is then ready for the oxidation necessary to convert the thionates thiosulphates into sulphates. This step is necessary because a large part of the ammonia content is in the form of sulphite, and is not in the most available commercial form. For this reason the hot liquor is treated with sulphur dioxide and an excess of air, after which it contains from 30 per cent. to 45 per cent. of ammonia sulphate, the original amount of ferrous sulphate in solution, and all the sulphur extracted from the gas in the form of free, precipitated sulphur. The sulphur is separated by filter pressing, and enough is burned to furnish sulphur dioxide, the remainder being for sale.

The liquor in the filter press is treated with the crude gas, the ammonia and the hydrogen sulphide content decompose the ferrous sulphate, forming insoluble ferrous sulphide and soluble ammonium sulphate. The ferrous sulphide is separated by filter pressing, and the liquor consists of a pure aud concentrated solution of ammonium sulphate, which is obtained by evaporation.

The residue of the filter press, consisting of ferrous sulphide with some inherent ammonium sulphate liquor, is mixed with fresh liquor and sulphur dioxide. Soluble ferrous thionate, thiosulphate and sulphate are formed and are used again for the extraction of ammonia, and hydrogen sulphide.

Now this process is deeply technical, and requires constantly skilled supervision and attention. Several points selected at random will serve to illustrate this: Frequent gassing with sulphur dioxide is required, and this is not merely a haphazard addition of the gas, but a very precise operation, with frequent testing to determine the proper amounts. Again the oxidation of the sulphite to sulphate is an operation which the unskilled workman cannot perform. However this method shows many desirable features:

Ammonia.

The extraction is independent of temperature.

A continued use of the same liquor is possible.

Ammonia is easily secured from a saturated solution as ammonium sulphate.

No distillation required to secure the ammonia.

The use of sulphuric acid is avoided.

Hydrogen sulphide.

From 50 per cent. to 80 per cent. of the total hydrogen sulphide is extracted simultaneously with the ammonia.

After first washing liquors have been formed, no chemicals are required.

Sulphur is obtained as a by-product and is commercially saleable.

Apparatus.

It can readily be observed, from the appended sketch that the plant is not complicated; and since it requires very little space, may be put in any ordinary building.

Power and steam are low.

This is then the perfected Feld process for coal gas purification. Laboratory practice has shown its efficiency on a small scale, but owing to the newness of its installation on a plant basis, it has not been thoroughly tried out on a large plan. It is true that two plants are making use of this system, but it is still, without a doubt, in the experimental stage.

The application of the Feld process to the removal of hydrogen sulphide only, has been made at the East Hull Gas Works, England, and since it is in continued use, we may infer that it has at least partially fulfilled the claims made for it.

The primary object in the East Hull installation was the complete removal of hydrogen sulphide and the subsequent recovery of free sulphur. It is quite simple and we will briefly outline it:

Zinc oxide is placed in a dissolving tank and covered with water. While the mixture is agitated, sulphur dioxide from a sulphur burner is passed into the tank. Excess of the sulphur dioxide passes into a still.

The resultant zinc sulphite solution is used to wash crude gas in a Feld centrifugal washer, and zinc thiosulphate is formed. The thiosulphate solution is then taken from the storage thanks through two Feld washers in series. The first washer removes approximately 75 per cent. of the hydrogen sulphide, the second taking out the remaining 25 per cent. Practically clean gas results.

After washing, zinc sulphide and free sulphur are precipitated. The mixture is pumped into the still, and then into the regenerator tanks. Sulphur dioxide is again pumped into the regenerator tanks, and as before, the excess goes into the still.

The zinc sulphide is changed into zinc thiosulphate in solution. Operations are then continued until the solution contains about 15 per cent. sulphur, when the liquor is treated with an excess of sulphur dioxide to put all the zinc sulphide entirely into solution as zinc thiosulphate.

The mixture is pumped through a filter press and sulphur is recovered. The thiosulphate in the liquor from the filter press is again used for extraction.

This process is comparatively simple, and may be used for coal or water gas purification. It would, however, seem to be most suitable to water gas operation. On its use in a plant of any size, it would easily pay the costs of operation through the sale of the recovered sulphur.

The Burkheiser Process of Gas Purification.—Another process of considerable interest is that patented by Burkheiser under the German and other codes. It is not a system based entirely on the idea of liquid purification, but it contains so much of that method that it merits description here. The following notes are partially a translation of an article by Dr. W. Bertelsmann (*Jour. Gas Ltg.*, page 23, Oct. 4, 1910). Five primary results are sought:

1. The absorption of the hydrogen sulphide from the gas.
2. The revivification of the fouled material with a coincidental formation of sulphur dioxide.
3. Formation of acid and neutral ammonium sulphite in solution.
4. Complete neutralization of the acid ammonium sulphite by further absorption of ammonia.
5. Oxidation of the ammonium sulphite to sulphate.

The hydrogen sulphide is absorbed by a natural or artificial ferric oxide. Burkheiser, however, heats this purifying material somewhat over 100° C., driving off any organic matter, and forming Fe_2O_3, H_2O, part of the water of hydration being driven off. This prepared oxide is of a deep red color and has the advantage of being very porous. Contrary to the general practice, it is used in the purifiers in the dry state, in beds from 6 to 10 feet thick. Approximately 20,000 times its volume of gas may be purified before the oxide needs revivification. This does not seem a very large amount, but when we consider that it means 25,000 cubic feet per bushel of oxide, it seems very efficient. The action is greatly hastened by a slight preheating of the gas and this also tends to eliminate any water depositing in the box. After fouling, the oxide is revivified by blowing air through the box. The oxidation proceeds vigorously and the resultant heat from the sulphur dioxide formation is used for the previously mentioned gas preheating. The ferrous sulphate and sulphuric acid formed are washed out of the oxide, which is dried and is then used again.

The ammonia in the gas is extracted by washing and the ammoniacal liquor is then used to wash the revivification gases, the ammonia and the sulphur dioxide reacting and forming both acid and neutral ammonium sulphite. The acid sulphite solution is then used to wash the gas, removing ammonia until it becomes neutral. It is again used to wash the gas containing sulphur dioxide forming the acid sulphite. The acid and neutral solutions are alternately formed until the solution becomes supersaturated and the salt begins to precipitate out. In ordinary operation, this salt is 60 per cent. sulphate and 40 per cent. sulphite of ammonia. The sulphite is sublimed and completely oxidized. A very pure ammonium sulphate results. This process has been handled on a large experimental scale, but no record of plant installation was available at the time of writing. Burkheiser is also proposing two other processes:

1. The conversion of the cyanides to ammonia through the formation of ammonium sulphocyanate, but he has not been able to push the proposal to a complete success.

2. He also proposes, by another patented process, to convert, by mild preheating and careful oxidation, one third of the contained hydrogen sulphide to sulphur dioxide, and cause this to react with the remaining hydrogen sulphide to form free sulphur and water. This proposal does not provide for the utilization of the sulphur and does not combine ammonia recovery with the sulphur extraction. Therefore, this method is not applicable to coal gas with any degree of efficiency. Other methods are being proposed, but those preceding will show the general type of liquid purification systems and serve as good illustrations.

A Proposed Liquid Purification for Water Gas.—Practically all of the systems developed are mainly for use in coal gas practice. However, since a vast amount of the American gas industry is based on the water gas type, the problem of working out some simple process, which was especially adapted to water gas, became very interesting. Hence, research has been carried on to discover some efficient liquid purifying agent for water gas. The process as developed is based on that ancient and well known reaction:

$$SO_2 + 4H_2S = 4H_2O + 3S_2.$$

Whenever sulphur dioxide and hydrogen sulphide meet in aqueous solution, or in the presence of moisture, they react to form water and free precipitated sulphur. The principal objects of this work were:

1. The absorption of the hydrogen sulphide from the gas.
2. The recovery of sulphur as a by-product.
3. A comparative cost statement, for installation and operation.

The method in brief is operated as follows:

A solution of sulphurous acid, or more properly sulphur dioxide, dissolved in water, is used to scrub the gas in towers or washers of any type, with one object, perfect contact between the gas and the liquor. As the contact is secured, the primary action takes place, and we have free sulphur and water as resultant products.

The required sulphur dioxide is supplied by a small burner with fan attachment. This gas is then passed into a small washer or simply an agitated vat for absorption by the gas saturated water. It is then drawn into the washers as needed. As the liquor becomes exhausted, it is again saturated with sulphur dioxide to any desired strength and is again used in the washers. The same solution can, therefore, be used indefinitely, or until limited by the cleanliness or volume of the liquor. This eliminates any necessity for constantly saturating with gas the liquor passing through the washers.

The precipitated sulphur may be carried in the solution until it forms about 15 per cent. by weight and is then removed by filter pressing. A portion of this sulphur is used in the sulphur burner and the remainder sold. According to the theory, ⅓ the sulphur must be re-used on each operation, but it is readily apparent that, after the first acid solution is prepared, all the sulphur extracted from the gas is for sale, because the acid solution is carrying practically the same sulphur content until it is finally exhausted and ready to be run into the sewer.

The simplicity of the plant may be seen by looking at the sketch through which we will also endeavor to show the course of the gas. For all practical work duplicate washers are absolutely necessary. They may be arranged, either in parallel or in series, the latter being without a doubt the better arrangement. The duplication is required for purposes of cleaning, or, in some cases, when a washer is show-

ing dirty gas, it is most desirable to run in series, in the same way that the boxes are run to-day.

As different types of washers may be used, a pump to force the liquor through them may or may not be required. For instance, if the "bubble" washer, designed by the Western Gas Construction Company, is used, no pump is needed to supply the liquor; but if the Feld centrifugal is used, a pump must be installed.

After the gas leaves the washer it is forced by a pump, either through or by-passing the filter press, to the sulphur dioxide saturator, where it is again prepared for use. In case the filter press is used, the sulphur is removed from the liquor, dried and stacked to await further use or sale. More of the details will be given later when the costs are considered.

The Experimental Work.—For the experimental work a gas line was carried from the outlet of the shaving scrubbers to the laboratory. In this way crude gas was obtained for the apparatus under the same conditions existing in the present purifiers. Since part of this work was carried on during the cold weather, the line was especially well provided with drain cocks to take care of any condensation, thus leaving the gas in the best possible condition.

The washing apparatus, although very simple, deserves mention. A large glass tube, and at times a duplicator, 2¼ by 22 inches, was filled with 60 ¼-inch tubes, supported in such a manner that the gas and the washing liquor passed both inside and outside them. This arrangement probably gives as large a surface as can possibly be obtained, and at the same time have an apparatus that will automatically pass all precipitated sulphur out the flush pipe. The checkered scrubber is not to be considered, for this reason: Any sulphur precipitating in the brickwork tends to impede the flow of gas, even heavy flushing failing to remove it.

The total absorption surface was 2,050 square inches. Convenient cocks were left on either side of the apparatus, so that samples of crude or clean gas could be easily obtained, pressures noted, etc. The only required reagent is a solution of sulphur dioxide in water, and this is prepared by the action of sulphuric acid on potassium sulphite.

Now, the first things for us to consider are the chemical checks on reagent, exhausted liquor, incoming and outgoing gas, the purity of the precipitated sulphur, etc. Determination of the sulphur dioxide content of the wash liquor.

This matter appears very simple, but we cannot, for instance, use the time-honored oxidation with bromine and precipitation with barium chloride. On a freshly saturated dioxide solution this method would be reasonably accurate, but, after the solution has been used as a wash liquor several times it carries a certain amount of suspended sulphur; hence, upon oxidation, the results would show a much higher sulphur content than we have available sulphur dioxide. For example, several analyses were made of a fresh solution and again after a succession of washings. The dioxide content should, of course, show a decrease.

Fresh solution.....4.6552 grams SO_2 per liter.
After first washing...4.6641 " " " "
After second washing .4.6698 " " " "
After third washing. .4.7050 " " " "

These analyses show that, instead of decreasing, as might naturally be expected, the sulphur dioxide content apparently increases, which is simply due to suspended sulphur. Besides, being erroneous on used solutions, the gravimetric method is entirely too slow. A standard alkali solution might also be used to titrate the dioxide in wash liquors, but, unfortunately, some sulphuric acid is always present in the solution and the results show much higher than the available sulphur dioxide warrants. Hence this method is not available.

The method proposed by F. Reich ("Chem. Zeitnng," 1858) and later described by Cl. Winkler in his "Anleitung zur Untersuchung der Industrie Gase," Part II., pages 118, 353, appears very promising. The basic reaction is:

$$I_2 + 2HO + SO_2 = H_2SO_4 + 2HI.$$

Iodine oxidizes the sulphur dioxide to sulphur trioxide by forming hydriodic acid. This reaction is reversible if more than .04 per cent. sulphur dioxide is present in the solution, according to Hempel, but later authorities assert that if the sulphur dioxide is run into the starch bearing iodine, instead of running the iodine starch into the dioxide solution, the reaction is not reversible even for strong solutions. This assertion was tested and the comparative results are given.

Titrating with iodine starch solution. Titrating with sulphur dioxide solution. Grams of sulphur dioxide per liter of wash liquor:

9.6052	10.4161
9.6001	10.4135
10.0142	10.4173
8.8760	10.4167
Average.. 9.5239	10.4164

From these results it is apparent that the result of the titration with iodine solution is low and not uniform. No trial of very weak solutions was made, as they are not concerned in this work. The titration itself is very simple. In all cases a blank iodine starch titration was made and the iodine correction for starch determined. The starch solution was made up according to the method given by Treadwell in ("Quantitative Chemical Analysis," Vol. II), 1 C. C. of starch solution was added to 50 C. C. of distilled water, and a previously determined amount of standard iodine solution run in from a burette. This mixture was then titrated with dioxide solution until the blue color entirely disappeared. A 300 C. C. Erlenmeyer flask is a most convenient vessel for the titration.

Analyses were made on a freshly saturated solution and comparisons made between the oxidations and the barium chloride precipitation methods:

	Iodine, Volumetric.	Barium Chloride, Gravimetric.
1.	.78442	.7856
2.	.78560	.7841
3.	.78442	.7862
4.	.78402	.7870
5.	.78456	.7851
6.	.78465	.7860
Average .	.78461	.7857

On a stronger solution:

	Volumetric	Gravimetric.
1.	2.47825	2.4615
2.	2.45115	2.4672
3.	2.44882	2 4656
Average	2.45941	2.4648

These analyses check fairly well, although the gravimetric is slightly higher. This may be due to the formation of a small amount of sulphur trioxide in the original solution, or errors in the washing and weighing of the precipitates. The iodimetric method is then sufficiently accurate to serve as a check on all wash liquors.

Checking the Purity of Outgoing Gas.—The Tutwiler, as used at present, could be used to show any hydrogen sulph ide escaping with the gas, and would also show sulphur dioxide blowing from an excessively saturated solution, but according to the reactions:

$$H_2S \quad 2I_2 \quad 4H_2O = H_2SO_4 \quad 4HI$$
$$SO_2 \quad I_2 \quad 2H_2O = H_2SO_4 \quad 2HI$$

Four grains of sulphur dioxide per 100 cubic feet of gas would only be equivalent to 1 grain of hydrogen sulphide in the Tutwiler reading hence any dioxide present in the outgoing gas would cause the readings to be abnormally low. It seems best, then, to use the silver nitrate stain, which will show any traces of hydrogen sulphide escaping and then use the Tutwiler. Any reading of the latter should be multipled by 4, if no trace of hydrogen sulphide is present. In case both are present in any quantity, the Referee's Test for total sulphur seems at present the only really accurate method to use. The hydrogen sulphide might be determined as in steel analysis, but that is too long and complicated to use as a check. The gas entering the washers is checked with the Tutwiler for the hydrogen sulphide content.

Tests on the By product Sulphur.—The sulphur produced will not stand as a first class article. By this we mean a sulphur falling under 99.5 per cent. purity. The analyses taken vary considerably. In the crude gas at our disposal, the tar content varied and seemed to depend somewhat on the condition of the shaving scrubbers, but for the most part was simply the tar mist coming through all dry scrubbers. The wash liquors darkened slightly and nearly all the condensed tar came with the sulphur. This problem may be solved by the use of the hot tar spray washers or scrubbers. Thus the quality of the sulphur should be improved.

The average purity of the sulphur as shown, 97 785 per cent., does not meet the requirements of the powder and other industries using a 99.5 per cent. refined sulphur, but it would form an admirable agent for bleaching, insecticide and acid making, etc. Hence it would be used by the textile, agricultural, paper, syrup and acid industries. In time we are convinced that all the sulphur turned out of the gas plants will be refined because the necessity is certain to show a cheap

method of refining. But at the present time the grade of sulphur produced can be disposed of at a fair price for the crude product.

Operation of the Experimental Apparatus.—Since we have examined the various checks on reagents and products, we will turn to the actual purification and note the influence of various agencies: Temperature, varying sulphur dioxide saturation, etc., on the process. In nearly every instance the duration of each test was 2 hours. Variations in temperature were easily secured since the testing began in the summer and continued until mid-winter. The gas rate per hour, square foot, etc., are all given on a corrected basis.

The analyses of the product are:

No.	Crude Sulphur.	Per Cent. Ash.	Per Cent. Organic.	Per Cent. Sulphur.
1.....	.1 gram	.06	0.74	99.20
2.....	"	.10	4.26	95.64
3.....	"	.05	2.80	97.15
4.....	"	.10	3.20	96.70
5.....	"	.07	0.76	99.17
6.....	"	.09	3.38	96.53
7.....	"	.12	1.14	98.74
8.....	"	.03	2.42	97.55
9.....	"	.07	1.89	98.04
10.....	"	.04	0.83	99.13
Average		.073	2.142	97.785

TABLE A.

No.	Liters Solution Per 24 Hrs.	Per Sq. Ft	Cu. Ft. Gas Per 24 Hrs.	Per Sq. Ft.	Grams SO_2 Per Liter.	Temp. Solution, Deg. F.
1.....	172.80	12.2	22,800	1.61	.78442	64
2.....	175.20	12.3	22,728	1 61	.86200	64
3.....	174.75	12.3	22,585	1.59	.81540	66
4.....	175.00	12.3	22,600	1 60	2.60747	66
5	176.05	12.4	22,550	1.59	7.46515	64
6.....	175.80	12.3	22,580	1 59	14.74219	64
7.....	175.15	12.3	22,745	1.61	19.65142	62

No.	Temp. Deg. F.	H_2S Grs. Per 100 Cu. Ft. Crude	H_2S and SO_2 in Grs Per 100 Cu. Ft., Purified.	Stain with Lead Acetate.
1.....	74	80	5 —	None
2.....	75	85	4 —	"
3.....	78	120	6 —	Slight
4.....	77	110	3 —	None
5.....	74	90	3 —	"
6.....	74	90	– 7	"
7.....	71	90	– 14	"

TABLE B.

No.	Solution Per 24 Hours. Liters.	Per Sq. Ft.	Cu. Ft. Gas Per 24 Hours.	Per Sq. Ft.	Grams. SO_2 Per Liter.	Temp. Sol. Deg. F.
1.....	172.80	12.2	1,421.50	100.10	9.81065	64
2.....	150.00	10.5	1,422.45	100.18	9.81070	63
3.....	120.00	8.4	1,420.15	100.01	9.81066	63
4.....	90.45	6.4	1,421.20	100.08	9.81068	64
5.....	75.55	5.3	1,422.10	100.18	9.81072	65
6.....	60.06	4.2	1,420.18	100.01	9.81074	64
7.....	50.10	3.5	1,422.15	100.17	9.81065	65

No.	Temp Degs. F. Gas.	H_2S Grs per 100 Cu. Ft. Crude.	H_2S & SO_2 Grs. per 100 Cu. Ft. purified.		Stain with Lead Acetate.
1.....	74	80	3	—	None
2. ...	76	80	3	—	"
3.....	71	90	3	—	"
4.....	68	85	7	—	Stain
5.....	72	85	9	—	"
6.....	72	85	9	—	"
7.....	72	85	15	—	"

Curves for these tables.

TABLE C.

No.	Liters solution per 24 hours.	Per Sq. Ft	Cu. Ft. gas per 24 hours	Per Sq. Ft.	Grams SO^2 per liter	Temp. Sol. Fo.
1.....	120.00	8.4	1420.20	100.00	9.81075	65
2.....	120.00	8.4	1435.50	101.90	9.81070	65
Cut exposure area to one-tenth of 1.42 Sq. Ft.						
3.....	120.00	18.4	1440.45	1014.40	9.81074	65
4.....	120.00	18.4	1425.50	1004.00	9.81071	65
5.....	120.00	18.4	1440.60	1014.70	9.81070	65
Returned to full exposure.						
6.....	120.00	8.4	1200.40	84.54	9.81068	64
7.....	120.00	8.4	900.40	63.41	9.81068	64
8.....	120.00	8.4	700.50	49.33	9.81050	67
9.....	120.00	8.4	515.60	36.31	9.81064	67
10.....	120.00	8.4	320.15	22.55	9.81065	66
11.....	120.00	8.4	180.96	12.74	9.81070	66
12.....	120.00	8.4	156.00	10.95	9.81055	66
13.....	120.00	8.4	73.80	5.20	9.81078	65
14.....	120.00	8.4	48.36	3.40	9.81064	64
15.....	120.00	8.4	20.64	1.45	9.81072	65

No.	Temp. gas. Degs. F.	H^2S Grs. per 100 Cu. Ft. crude.	H^2S & SO^2 in Grs. per 100 Cu. Ft. purified.	Stain with lead acetate.
1. ...65		90	2	None
2.....65		90	2	"
3.....66		90	6	Stain
4.....66		90	5	None
5.....65		90	6	Stain
5.....66		85	6	None
7.....66		85	2	"
8.....65		90	2	"
9.....64		90	2	"
10.....66		90	—	"
11.....66		85	—	"
12. 65		90	—	"
13.....64		90	—	"
14.....66		95	—	"
15.....66		90	—	"

TABLE D.

Varied liquor rate.

No.	Liters solution per 24 hours.	Per Sq. Ft.	Cu. Ft. gas per 24 hours.	Per Sq. Ft.	Grams SO^2 per liter.	Temp. Degs. F.
1.....120.00		8.4	1,420.00	100.00	9.81056	83
2.....120.00		8.4	1,425.00	100.35	9.81070	74
3.....130.00		8.4	1,423.15	100. 2	9.81060	56
4.....120.00		8.4	1,421.45	100.10	9.81074	40
5.....120.00		8.4	1,422.54	100.18	9,81065	35

No.	Temp. gas Degs. F.	H^2S Grs. per 100 Cu. Ft. crude.	H^2S &SO^2 in Grs. per 100 Cu. Ft. purified.	Stain with lead acetate.
1.... 88		105	2	None
2.....86		100	2	"
3.....87		100	2	"
4.....85		110	2	"
5.....86		105	2	"

Curves for these tables.

TABLE E.

Varied gas temperature.

No.	Liters Solution per 24 hours.	Per Sq. Ft.	Cu. Ft. gas per 24 hours.	Per Sq. Ft.	Grams SO_2 per liter	Temp. Sol. Deg. F.
1. ...120.00		8.4	1,420.00	100.00	9.81076	60
2....120.00		8.4	1,425.00	100.35	9.81070	62
3.....120.00		8.4	1,423.15	100.22	9.81075	66
4.....120.00		8.4	1,418.15	99.87	9.81052	63
5.....120.00		8.4	1,419.25	99.94	9.81064	62

No.	Temp. gas Deg F.	H_2S Grs. per 100 Cu. Ft. Crude.	H_2S & SO_2 Grs. per 100 Cu. Ft. Purified	Stain with lead acetate.
1....88		100	2	None
2.....74		105	2	"
3. . 66		100	2	"
4.....60		100	2	"
5.....55		100	2	"

TABLE F.

Varied H_2S content in crude gas.

No.	Liters Solution per 24 hours.	Per Sq. Ft.	Cu. Ft Gas per 24 hours.	Per Sq. Ft	Grams SO^2 per liter.	Temp. Sol. Deg. F.
1.....120.00		8.4	1,421.45	100.10	9.81066	65
2.....120.00		8.4	1,423.60	100.25	9.81074	65
3.....120.00		8.4	1.422 18	100.15	9.81077	64
4.....120.00		8.4	1,421.15	100.08	9.81080	65
5.....120.00		8.4	1,420.16	100.01	9.81068	63
Formula from practice on experimental apparatus.						
6.....120.00		8.4	1,420,00	100.00	9.81070	65

No.	Temp. Gas Deg. F.	H_2S Grs. per 100 Cu. Ft. crude.	H_2S & SO_2 in Grs. 100 Cu. Ft. purified.	Stain with Lead Acetate.
1.....75		150	3 None	None
2.....78		120	2 "	"
3.....76		105	2 "	"
4.....76		90	2 "	"
5.....75		80	2 "	"
6.....75		150	3 "	"

The preceding tables show just how the purification was affected by keeping as nearly as possible all conditions exactly similar, with

the one exception mentioned in each case. For example: In Table A practically all conditions were similar for all the tests, excepting the sulphur dioxide content of the wash liquor, which was varied so as to show maximum and minimum limits. This, then, gives the most economical concentration for ordinary practice. The concentration of the dioxide ranged from .78442 to 19.65142 grams per liter of water. Theoretically about 75 grams of sulphur dioxide would represent a fully saturated solution. In the experimental work, as the table and chart show, the dioxide seems to be carried off by the gas after the saturation passes about 10 grams per liter. For example, in tests 6 and 7 no stains appeared even with silver nitrate on long exposure, but the Tutwiler gave an equivalent of 7 and 14 grains of sulphur dioxide respectively. This, then, seems to show conclusively that, above a certain degree of saturation sulphur dioxide is given off by an agitation of the solution, and since it is as much of an objection as the hydrogen sulphide, that degree of saturation must not be exceeded. This escape of the dioxide seems partially to be independent of the temperature to which the solution is subjected.

Table B illustrates a maximum and minimum amount of wash liquor per square foot of the washing surface per 24 hours from 12.2 to 3.5 liters. Notice the tests 3 and 4. In test 3 the amount of liquor per square foot per 24 hours was 8.4 liters with a hydrogen sulphide content of 3 grains in the purified gas; in test 4 with a reduction of only 2 liters per square foot per 24 hours, the sulphide content advances to 7 grains per cubic foot. This sharp contrast then shows 2 probable causes: Insufficient covering of the washing surface or not enough dioxide to properly carry out the reaction. We have, however, theoretically a heavy excess of the reagent, and in proportion it has purified large amounts of gas per liter of solution, so we must couclude that this excess of hydrogen sulphide in the purified gas is simply due to an insufficient covering of the purifying surface. From this series of tests, it appears that 8.4 liters per square foot give the best results. Lower amounts may prove effective in large installations, for in this case approximately 120 liters of the wash liquor per 24 hours was required to properly flush all the absorption surface. In case the latter object is attained we see no reason why a smaller amount of solution is not sufficient, containing, as it does, an excess of sulphur dioxide.

Table C shows a gas rate varying from 20.64 to 1,014.70 cubic feet in 24 hours for each square foot of exposure area. From the data, approximately 1,000 cubic feet of gas can be handled per square foot per 24 hours. The hydrogen sulphide will run from 3 to 5 grains per 100 cubic feet, but such low amounts cannot be objectionable.

Table D is an illustration of varying liquor, and Table E of varying gas temperatures. In D, the variation was from 35° F. to 83° F., and in E, 55° F. to 88° F. Both of these tables bear on one factor: The temperature of reaction. It is generally realized that most reac tions are hastened by the application of heat, but in this work the difference was so slight that it could not be detected. We might then venture to assert that this reaction of hydrogen sulphide and sulphur dioxide can take place when the temperature of the gas or the solu tion ranges between 33° F. and 100° F. The upper limit may be even higher, but purifying temperatures above 100° F. are an uncommon occurrence in water gas practice and as for the lower limit it is absolutely fixed.

Table F shows a heavy variation in the hydrogen sulphide content from 80 to 150 grains per 100 cubic feet of the crude gas. It may be that an excess of solution was used, but the tests showed practically no difference in the purified gas. This tends to show that no secondary washer is absolutely necessary since nearly all the sulphide is removed in the primary washing. Practice might show, however, that more efficient operation is secured by connecting two washers in series and passing the gas through much more rapidly. No. 6 of Table F was devised to show a running formula for a tubular washer, showing approximately the amount of solution rate of gas flow and dioxide saturation found by experiment to give good results. Now, the great point about this washing system is that on ordinary washers where absolute contact is obtained about 1,000 cubic feet of gas can be washed per square foot per 24 hours. This is something that should attract the attention of every gas man. A plant with a 10 million capacity would require roughly 10,000 feet of absorption area, and by the use of some of the washers on the market at present, the above area would be lessened considerably.

Effects on the Quality of the Gas.—Another point of great importance is the effect of a sulphurous washing on the quality of the gas. Will it change the gas detrimentally? If so, to what extent.

Samples for this work were taken when the apparatus was running under conditions of test No. 6, Table F. Since the illuminants are powerfully attacked by sulphuric acid, we might reasonably expect to find sulphurous acid having a similar, although lesser, effect. The carbon dioxide might also be taken into solution to a certain extent, but, after the liquor is once saturated, this action should not be apparent. To ascertain the effect on the entire gas composition, a number of complete analyses were made of first the crude gas and then its corresponding washed form. These samples were run on a Morehead burette. The analyses were run as uniformly as possible in order to secure comparative results.

CRUDE GAS.

No.	CO_2.	Ill.	O.	CO.	H.	CH_4.	N.
1	4.0	12.6	0.7	29.4	29.8	17.6	5.9
2	3.9	12.6	0.7	29.4	29.8	17.6	6.0
3	3.8	12.6	0.7	29.5	29.8	17.6	6.0
4	3.9	12.6	0.6	29.5	29.8	17.6	6.0
5	4.2	12.2	0.6	29.0	29.9	17.9	6.2
6	4.2	12.2	0.6	29.1	29.9	17.9	6.1
7	4.2	12.2	0.7	29.0	29.9	17.9	6.1
8	3.7	12.5	0.7	29.3	29.8	17.7	6.3
9	3.7	12.5	0.7	29.4	29.7	17.7	6.3
10	3.7	12.5	0.7	29.3	29.7	17.6	6.5
Aver.	3.93	12.45	0.67	29.29	29.81	17.71	6.14

WASHED GAS.

No.	CO_2.	Ill.	O.	CO.	H.	CH_4.	N.
1	3.9	12.4	0.7	29.4	29.8	17.6	6.2
2	3.9	12.5	0.7	29.4	29.8	17.6	6.1
3	3.8	12.5	0.7	29.4	29.8	17.6	6.2
4	3.8	12.5	0.7	29.5	29.8	17.6	6.1
5	4.2	12.2	0.6	29.1	29.9	17.7	6.1
6	4.1	12.1	0.7	29.1	29.9	17.9	6.3
7	4.2	12.1	0.7	29.0	29.9	17.9	6.2
8	3.6	12.5	0.7	29.2	29.8	17.7	6.5
9	3.7	12.4	0.7	29.4	29.7	17.7	6.4
10	3.6	12.4	0 7	29.3	29.7	17.7	6.6
Aver.	3.88	12.36	0.68	29.28	29.81	17.72	6.27

From a comparison of the results, we find the carbon dioxide in the washed gas .05 per cent. lower than in the crude, which difference is probably due to the presence of the acid hydrogen sulphide in the crude gas. As this is removed with the carbon dioxide the results for carbon dioxide in crude gas are high; therefore, the washing has practically no effect on the carbon dioxide content. The decrease of illuminants is .09 per cent., due to washing. Since this decrease is less than $\frac{1}{10}$ of 1 per cent., it need not be considered a serious objection. It is a well known fact that strong sulphuric acid will take up illuminants, but from these results it is apparent that sulphurous acid has very little effect upon the hydrocarbons. It seems very fortunate that the wash liquor has no strong effect on the illuminant content of the gas, for if such were not the case the method could not be considered for a moment.

The Required Plant.—Two types of washers considered by the writer seem well adapted to supply the one essential requirement of this process—perfect contact between the liquor and the gas. The first washer, manufactured by the Bartlett-Hayward Company, is known as the Feld centrifugal. It was designed and used primarily in the Feld process outlined at the beginning of this paper. Its principle is comparatively simple. The washer, in tower form, is divided into horizontal, vertically communicating compartments. The gas enters the bottom and passes from chamber to chamber to an outlet at the top. The liquor enters the top and overflows through the successive chambers to the bottom, where it is drawn off. A shaft, geared to a motor, extends vertically through the tower. Attached to it in each chamber are the concentric cones. As the shaft revolves the rotating cones pick up the liquor on the floor of each compartment, whirling it up as an exceedingly fine spray, to come in contact with the upcoming gas. This seems to give splendid contact. The probable difficulty in its use is the manner of cleaning. Sulphur will be precipitated in the washer itself, and if this cannot be easily removed, then the purification will be quite difficult. Its use, moreover, will require the addition of another pump to the plant equipment to force the wash liquor to the top of the washer. The operation of this apparatus should be easily understood from the attached diagrams. The other prominent type is handled by the Western Gas Construction Company, and known as a "bubble washer." The liquor in this type is stationary, simply overflowing at any desired

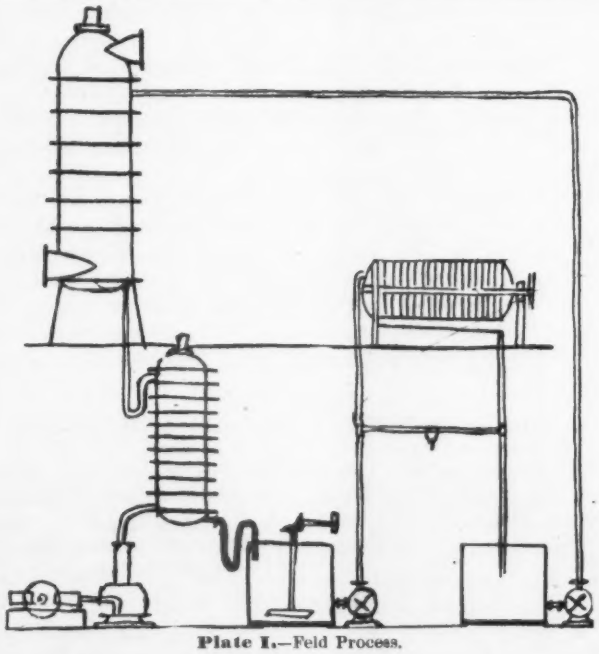


Plate I.—Feld Process.

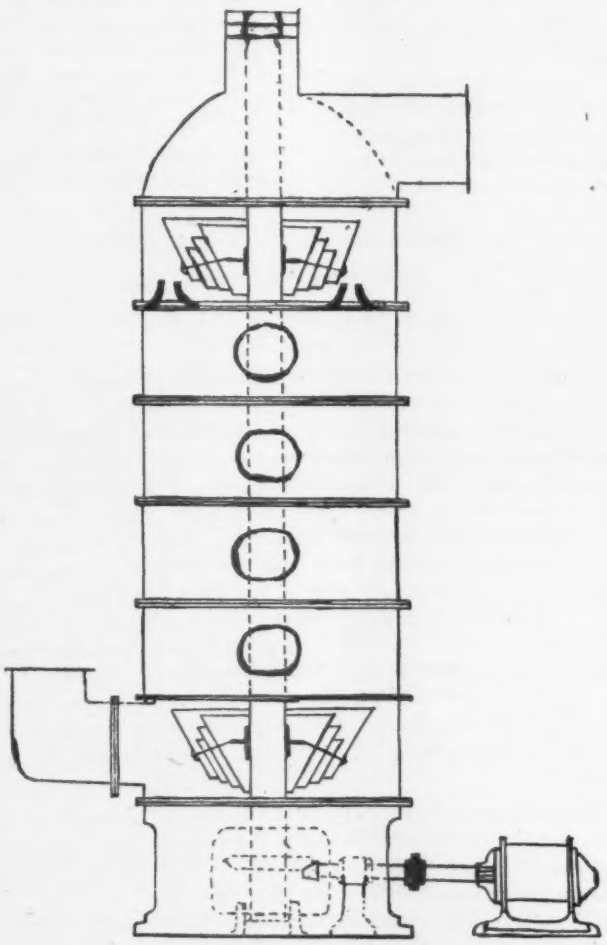


Plate II.—Feld Washer.

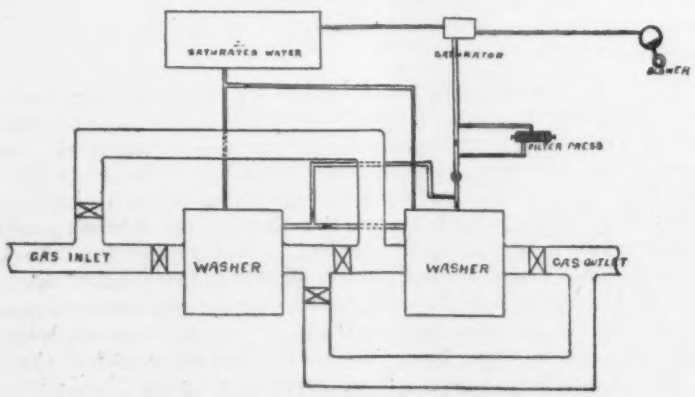


Plate III.—Liquid Purification Plant.

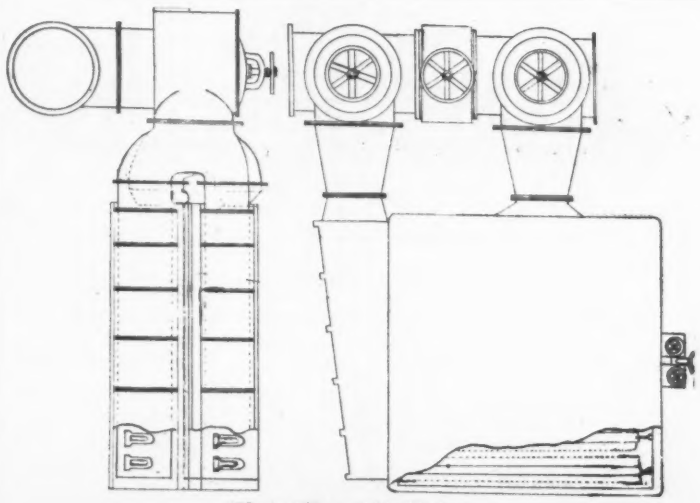
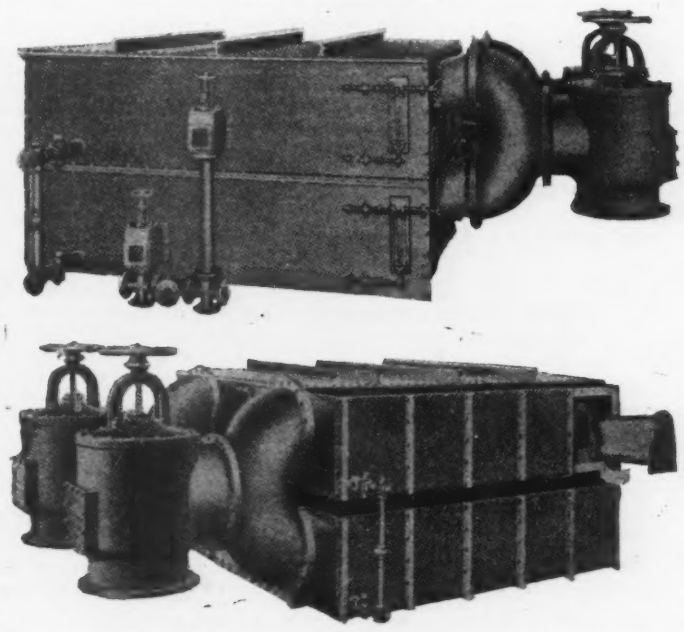
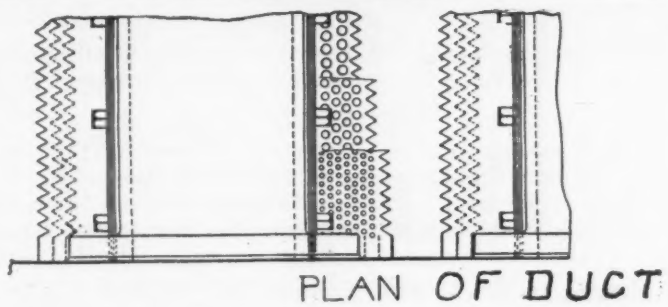
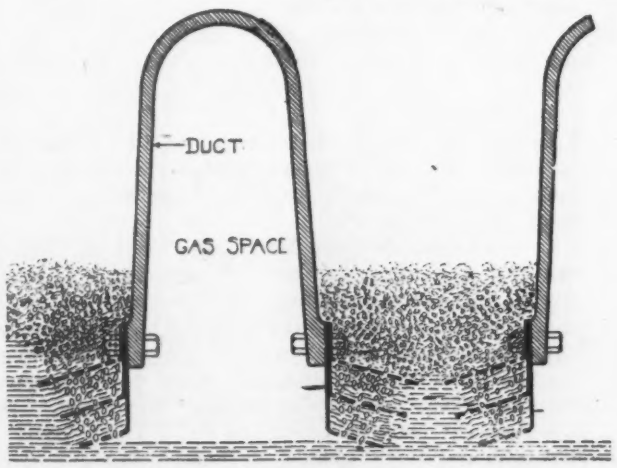


Plate IV.—Bubble Washer.







SECTIONAL ELEVATION

(*Continued on page 42.*)

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NEW YORK, MONDAY, JULY 15, 1912.

[Official Notice.]

Transportation Announcement, Respecting the Coming Meeting, American Gas Institute.

American Gas Institute,
Sub Committee on Transportation,
Chicago, Ills., June 29, 1912.

For the comfort and enjoyment of those proposing to attend the October meeting of the Institute at Atlantic City, arrangements have been made for the following special train and car service:

Special Trains.

"I. C. Copley, Special".....from Chicago to Atlantic City.
"W. R. Addicks, Special"... from New York City to Atlantic City.
"Walton Clark, Special".....from Philadelphia to Atlantic City.

Special Cars.

"W. A. Wood, Special".....from Boston to New York City.
"C. L. Holman, Special".....from St. Louis to Atlantic City.
"J. T. Lynn, Special"..... from Detroit-Toledo to Atlantic City,
"Donald McDonald, Special" from Louisville-Cincinnati to Atlantic City.

All special trains will be run independently. The "W. R. Addicks Special," from New York City, and the "I. C. Copley Special," from Chicago, will not stop at Philadelphia, although these trains will stop at other important cities en route. Those taking the "W. A. Wood Special," from Boston, will be transferred at New York City to the "W. R. Addicks Special."

The "C. L. Holman Special," from St. Louis, "J. T. Lynn Special," from Detroit-Toledo, and the "Donald McDonald Special," from Louisville-Cincinnati, will connect without change with the "I. C. Copley Special," at Pittsburgh, Pa.

The "W. A. Wood Special," from Boston, the "W. R. Addicks Special," from New York City, and the "Walton Clark Special," from Philadelphia, will be scheduled for "daylight runs;" the "W. A. Wood Special," will leave Boston the morning of October 15th; the "W. R. Addicks Special," from New York City and the "Walton Clark Special," from Philadelphia, will leave their respective cities that afternoon. The "I. C. Copley Special," from Chicago, the "C. L. Holman Special," from St. Louis, the "J. T. Lynn Special," from Detroit-Toledo, and the "Donald McDonald Special," from Louisville-Cincinnati, will leave their respective cities the afternoon of the day before (October 14th). All trains will be scheduled to arrive at Atlantic City in the late afternoon of October 15th—the day before the meeting.

It is anticipated that the Southeastern contingent will secure reservations on the "Walton Clark Special," from Philadelphia.

Leaving time of "Specials," rates and all necessary details regarding the securing of reservations, will be published in later issues of the American Gas Light Journal.

These special trains and cars, with the exception of the special car from Boston, will be run over the Pennsylvania Railroad lines, the Boston car over the New York, New Haven and Hartford Railroad. The equipment in each instance, as well as the service and schedule, will be in keeping with the high standard of these roads. The following are the names and addresses of the members of the Transportation Committee having charge of these "Specials:"

Special Trains.

"I. C. Copley Special" (Chicago to Atlantic City).	H.L. Rice, Gen. Mgr., Western United Gas and Elec. Co.. Aurora, Ills.
"W.R. Addicks Special" (New York City to Atlantic City).	W. Cullen Morris, Eng. of Const., Consolidated Gas Co., N. Y. City.
"Walton Clark Special" (Philadelphia to Atlantic City).	J. B. Klumpp, Inspecting Engineer, United Gas Improvement Co., Philadelphia, Pa.

Special Cars.

"W. A. Wood Special" (Boston to New York City).	N. W. Gifford, Genl. Mgr., East Boston Gas Co., Boston, Mass.
"C. L. Holman Special" (St. Louis to Atlantic City).	J. D. von Maur, Supt. Dist., Laclede Gas Light Co., St. Louis, Mo.
"J. T. Lynn Special" (Detroit-Toledo to Atlantic City).	A. L. Wilkinson, Treas., National Gas, Electric Light and Power Co., Ford Bldg., Detroit, Mich.
"Donald McDonald Special" (Louisville-Cincinnati to Atlantic City).	Wm. H. Crutcher, Supt., Kentucky Heating Co., Louisville, Ky.

B. J. Kellum,
Chairman of Sub-Committee on Transportation.

BRIEFLY TOLD.

Gas Pressure Regulation for the Borough of Manhattan.—The members of the Public Service Commission, First New York district, have been holding sessions, covering a period of several weeks, with a view of determining what would be the proper regulation respecting gas pressures at the consumers' burner in the borough of Manhattan. These hearings were many in number, and were characterized by complete openness and the evident thought and wish that fairness to all should be the impelling preliminary to the hearings on the subject. The technical part of the matter had been, on behalf of the Commission, thoroughly gone into by Mr. W. A. Baehr, of Chicago, who eventually submitted a most complete report regarding the matter committed to him for examination. Evidently, Mr. Baehr's findings were to the liking of the Commission, for their final presentation virtually accepts the Baehr studies as the basis of such presentation. The order in the premises, as entered the 21st ult., is appended:

"A hearing having been duly held on motion of the Commission * * * and the Commission being of the opinion that the acts and regulations of the gas corporations supplying gas in the Borough of Manhattan are unreasonable; Now, therefore, it is

"Ordered, that the Consolidated Gas Company, of New York, New Amsterdam Gas Company, The New York Mutual Gas Light Company, and The Standard Gas Light Company of the City of New be and they hereby are directed to comply with the requirements and regulations below set forth:

"1. Each gas corporation supplying gas for light, heat or power in the Borough of Manhattan, City of New York, shall provide and maintain recording pressure gauges of a type to be approved by the Commission, so located that no gas consumer will be more than 3,800 feet in an air line from the nearest gauge upon the distribution system by which he is supplied, and that there will be at least 1 gauge in each square mile of territory supplied by each corporation. Each gauge shall be located as nearly as practicable to the point of minimum pressure in its district, and a separate service shall in each case be run from the gas main to the gauge, no gas consumption being taken from said service. Each chart taken from these gauges shall be marked with the company's name, location of gauge from which

it was taken and the date it was placed and removed, and shall be filed and preserved by the corporation for nct less than 3 years. On or before November 1st, 1912, each corporation shall notify the Commission of the location of each gauge, and also of all changes in location and new locations of gauges within 5 days from the date of such change or new location.

"The provisions of this paragraph (1) shall take effect November 1, 1912.

"2. On and after July 1, 1913, the minimum pressure of gas, as measured at the consumer's end of the company's service pipe to any consumer, shall not be less than two inches water column on two consecutive days. Where the company is or will be unable to maintain such minimum pressure, on account of causes beyond its control it shall immediately notify the Commission and request an extension of time within which to comply with this provision, and said company shall comply with this provision within the time thus fixed.

"3. On and after July 1, 1913, the maximum pressure of gas, as measured at the consumer's end of the company's service pipe to any consumer, shall not exceed 6 inches water column on 2 consecutive days, unless the consumer or consumers supplied from such service pipe have made a specific request in writing for pressure of or in excess of 6 inches water column. This provision shall not be construed as imposing any obligation on the company to furnish gas at a pressure of 6 inches or more.

"4. On and after July 1, 1913, the maximum daily pressure variation (independent of momentary and pulsating variations of pressure) as measured at the consumer's end of the company's service pipe to any consumer shall not exceed 3 inches water column on two consecutive days. On and after July 1, 1915, said maximum daily pressure variation shall not exceed 2½ inches water column on two consecutive days. On and after July 1, 1915, such maximum daily pressure variation shall not exceed 2 inches water column on 2 consecutive days.

"5. Ou and after Januaryy 1, 1913, the maximum momentary pressure variation (defined as a sudden increase or decrease of pressure, practically instantaneous and not recurring with regular periodicity or frequency, nor necessarily with the same amplitude) at the consumer's end of the company's service pipe to any consumer shall not exceed a total range of 8-tenths inches water column on 2 consecutive days.

"6. On and after July 1, 1913, the maximum pulsating pressure variation (defined as a sudden increase or decrease of pressure of short duration, practically instantaneous, and recurring with regular periodicity or frequency, and usually with approximately the same amplitude) at the consumer's end of the company's service pipe to any consumer shall not exceed a total range of 8-tenths inches water column on 2 consecutive days. On and after January 1, 1914, said maximum pulsating pressure variation shall not exceed a total range of 5-tenths inches water column on 2 consecutive days.

"7. This order shall take effect immediately except as herein provided and shall remain in force until modified or abrogated by further order of the Commission.

"8. Each of the companies above named shall notify the Public Service Commission for the First District within ten days after service of this order upon them whether the terms of this order are accepted and will be obeyed."

U. S. Government Hearing on Flange Fittings.—We are indebted to the courtesy of Mr. Calvin W. Rice, Secretary of the American Society of Mechanical Engineers, for this resume of a session, the results of which are certain to have important effect over the "flange fitting" question: The Navy Department, Bureau of Yards and Docks, Washington, D. C., held a hearing June 17th, for the purpose of giving certain manufacturers an opportunity to submit reasons why they are opposed to the 1913 U. S. specifications on Government work. The Government had representatives present from the following departments: Army, Navy, Auditing, Purchasirg, Bureau of Yards and Docks, Bureau of Standards. The manufacturers represented were: Crane Company, Walworth Manufacturing Company, McNab & Harlan, Best Manufacturing Co., Kelly & Jones. The Societies responsible for the 1912 U. S. standard were represented by Mr. Henry G. Stott, Member Council, American Society of Mechanical Engineers, and Mr. H. B. Gombers, Secretary of the National Association of Master Steam and Hot Water Fitters. Mr. Carl L. Carlson, Corps of Civil Engineers, U. S. Navy, presided. During the first part of the meeting the manufacturers' representatives, of whom Mr. A. M. Hauser (Crane Company) and Mr. Evans (Best Manufacturing Company), as spokesmen, put in their protest against the adoption by the Navy of the 1912 U. S. standard. Mr. H. B. Gombers, National Association of Master Steam and Hot Water Fitters, in replying, outlined the efforts of the Committees of the two Societies for the past 1½ years, by conducting extraordinary correspondence with the principal companies manufacturing fittings in America, and in every way trying to establish a standard which would best represent the interest of all, which resulted in the 1912 U. S. standard. Mr. G. H. Stott, Supt. Motive Power, the Interborough Rapid Transit Company, of New York, presented the desirability of adopting the new standard from the engineering point of view. By making use of a set of temperature and expansion curves the principal points emphasized were that the factor of safety in the ordinary pipe line was from 16 to 20, while the factor of safety in the bolts was 2 or less, so that everything possible should be done to bring up the factor of safety in the the bolts, flanges and fittings, especially in view of the enormous strains encountered due to change in temperature. By comparing the 1912 U. S. standard with the proposed manufacturers' standard, the British and German standards, it was shown that the 1912 U. S. standard was the heaviest and strongest of all. Another important feature of the 1912 U. S. standard was shown to be the interchangeability of parts, where the proposed manufacturers' schedule has different face-to-face dimensions, and that the changes referred to extra heavy work and to sizes above 9 inches only. The consensus of opinion at the hearing was in favor of the 1912 U. S. standard. The chief objection the manufacturers offered was the enormous cost to them. It developed, however, from the testimony of one of the manufacturers present, that the cost of the change to the new standard would practically be very little, for they had already been through the experience once within the past 2 years, which lack of expense was due to the fact that they did not use iron patterns or special tools in their work, but did all their facing on lathes and facing machines. During the remainder of the hearing the discussion settled down to what time would be necessary before everyone could be supplying material according to the 1912 U. S. standard, and the general consensus of opinion seemed to be that within 2 years the new standard would probably become universal.

First Annual Meeting of the "Gas Meeters."—The "Gas Meeters," of New York City, are looking forward to their first annual meeting which ts to be held in September. This will be the tenth regular meeting and dinner, and from the attendance at previous gatherings there seems to be the need of such an organization in a city, even as busy as New York. The object of the Association is good fellowship, but the lectures, demonstrations and discussions which have been features of the meetings would do credit to some of the older and larger bodies of gas men. At the present time no dues are charged and those who desire to receive notices of future meetings are requested to communicate with the Secretary, Mr. H. Thurston Owens, 42 Pine Street, New York City.

Report of Massachusetts Board of Gas and Electric Light Commissioners.—The Board of Gas and Electric Light Commissioners has issued its 27th annual report. It covers the operations of 148 companies, persons, etc., supplying gas and electricity for the year 1911. As usual, the most comprehensive data published in such manner will be found in the 200 odd pages devoted to statistics, etc. Orders and decisions occupy 100 pages and legislative reports another 100. An added chapter contains the names and addresses of the principal officers and directors.

CURRENT MENTION—

Mr. E. R. Lewis, Secretary of the National Gas Light Company, Kalamazoo, Mich., informs us that the W. F. Boardman Company, of 793 Mission street, San Francisco, Cal., has been appointed agent for the Beau Ideal gas arc, the new lamp that is being manufactured by the National Gas Light Company.

At the annual meeting of the New England Section, Illuminating Engineering Society, the following officers were elected: Chairman, R. B. Hussey; Secretary, H. C. Jones; Managers, H. C. Clifford, C. A. B. Halvoran; J. M. Riley, R. C. Ware and W. E. Wickenden.

Elsewhere we note the taking over of the Utah Coke and Gas Company by the American Utilities Company, as successors to the corporation known as Kelsey, Brewer & Co. The concern was capitalized in a total of $40,000,000, and it was thought (in fact it was so announced) that the real conversion of the properties could not be effected prior to September 1st. But the scheme was so favorably regarded by the shareholders that the amalgamation or substitution was accomplished by July 1st. The officers of the Company are: President, C. H. Kelsey; Vice-President and General Manager, Joseph H. Brewer; Secretary, Blaine Gavitt; Treasurer, Warren H. Snow; Assistant Secretary and Treasurer, W. J. Ripley; Operating Engineer, Samuel C. Shaffner.

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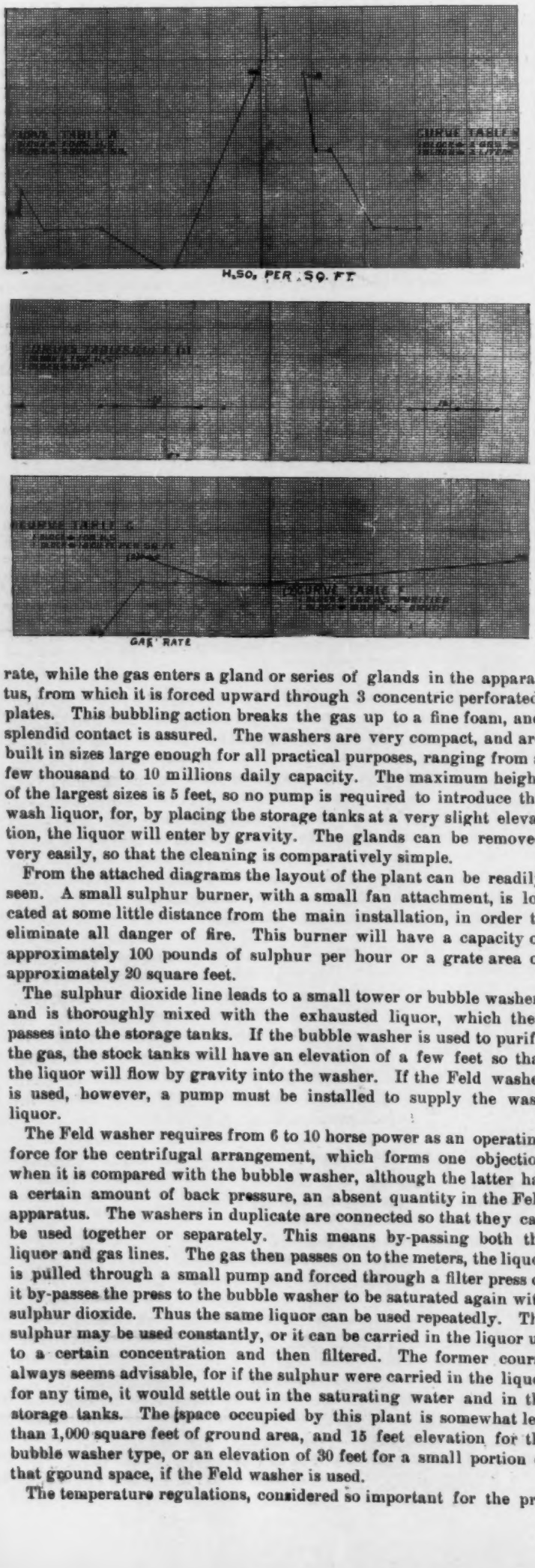


rate, while the gas enters a gland or series of glands in the apparatus, from which it is forced upward through 3 concentric perforated plates. This bubbling action breaks the gas up to a fine foam, and splendid contact is assured. The washers are very compact, and are built in sizes large enough for all practical purposes, ranging from a few thousand to 10 millions daily capacity. The maximum height of the largest sizes is 5 feet, so no pump is required to introduce the wash liquor, for, by placing the storage tanks at a very slight elevation, the liquor will enter by gravity. The glands can be removed very easily, so that the cleaning is comparatively simple.

From the attached diagrams the layout of the plant can be readily seen. A small sulphur burner, with a small fan attachment, is located at some little distance from the main installation, in order to eliminate all danger of fire. This burner will have a capacity of approximately 100 pounds of sulphur per hour or a grate area of approximately 20 square feet.

The sulphur dioxide line leads to a small tower or bubble washer, and is thoroughly mixed with the exhausted liquor, which then passes into the storage tanks. If the bubble washer is used to purify the gas, the stock tanks will have an elevation of a few feet so that the liquor will flow by gravity into the washer. If the Feld washer is used, however, a pump must be installed to supply the wash liquor.

The Feld washer requires from 6 to 10 horse power as an operating force for the centrifugal arrangement, which forms one objection when it is compared with the bubble washer, although the latter has a certain amount of back pressure, an absent quantity in the Feld apparatus. The washers in duplicate are connected so that they can be used together or separately. This means by-passing both the liquor and gas lines. The gas then passes on to the meters, the liquor is pulled through a small pump and forced through a filter press or it by-passes the press to the bubble washer to be saturated again with sulphur dioxide. Thus the same liquor can be used repeatedly. The sulphur may be used constantly, or it can be carried in the liquor up to a certain concentration and then filtered. The former course always seems advisable, for if the sulphur were carried in the liquor for any time, it would settle out in the saturating water and in the storage tanks. The space occupied by this plant is somewhat less than 1,000 square feet of ground area, and 15 feet elevation for the bubble washer type, or an elevation of 30 feet for a small portion of that ground space, if the Feld washer is used.

The temperature regulations, considered so important for the present purification, need not be so rigidly observed in the proposed plant. The only requirement in this line is a temperature above freezing. Approximately 1 ton of sulphur is recovered from a 10 million capacity plant per 24 hours. This sulphur can be dried, packed on the purifying floor and stored in any dry place to await shipment. The labor required is the service of two intelligent men for at least 18 hours of the 24. By this we do not mean constant attendance, but continuous supervision.

The cost of installation of a plant as outlined will run approximately $12,000; and this, with added charges for incidentals, will run about $15,000 as a gross cost. This is just one-fourth the cost of an oxide purification system having the same capacity. The old system represents an investment of $60,000 for the equipment alone, and in this we do not consider the value of the land occupied, which varies according to locality.

The cost of operation of this plant is comparatively low. Steam and power are at a minimum, and, in the use of one type, is practi cally nothing. The cost of chemicals is nothing and the cost of attendance is high, if rated at $6 per day; $4,000 per year will cover the cost of operation; depreciation at 10 per cent., $1,500 yearly; interest and other charges, $2,000 per year; or a total for operating costs of $7,500 yearly. To pay this we have an asset of 360 tons of sulphur selling for a minimum of $20 per ton, or a total of $7,200 per year. In these estimates, the available resources have been purposely lowered and the operating costs have been raised. Hence we can say that the process will pay for itself. As a comparison we can say roughly that a 10 million daily capacity plant under the oxide system is costing $12,000 and not 1 cent is received from it to pay these charges. The advantages of this system are as follows:

1. The same gas saturated liquor can be used repeatedly.
2. The plant, as regards space and apparatus, is very small.
3. Very simple reactions; instantaneous and independent of temperature.
4. Removes the necessity for handling large masses of solids.
5. Produces all the sulphur as a by-product, which pays the costs of operation.
6. Makes clean gas.
7. Reagent, simple and inexpensive.
8. Easily operated and requires no expensive skilled labor.
9. If the Feld washer is used, there is practically no back pressure in the system.
10. Its use means small investment, consequently low interest and depreciation.

These advantages we think will appeal to every gas man and will open for him a new field of endeavor. And, let us say in conclusion, that, unless endeavor is made and new lines of thought followed, the gas business is going to slowly but surely go down.

(To be Continued.

[Continued from Page 30.]

FOURTH ANNUAL MEETING, SOUTHERN GAS ASSOCIATION.

Held in the Seminole Hotel, Jacksonville, Fla., April 17, 18 and 19, 1912.

Second Day—Morning Session.

Chairman White—The next paper is that by Mr. Charles Leech (Macon, Ga.), on

METER AND METER REPAIRS.

The dry gas meter has been described as the most ingenious measuring apparatus of this or any past age, and the most positive, outside of a wooden or metal measure. The present type with which we are all more or less familiar has been in use for nearly 70 years, the only difference being in the sizes and shapes of various parts; the principle is identical.

Mr. John Glover, son of the original maker, once said that the inventor took the idea from the steam engine, and if you look into it you can readily see the similarity, but it is really the plan of 2 engines working on the same crankshaft; or, as we call it in the meter, the tangent. Each side of the lower part represents a cylinder, the diaphragm disks are the pistons, while the slide valves are identical.

The history of the meter in America has been so ably written by Mr. Donald McDonald, as published in the American Gas Light

JOURNAL (July 19, 1909), that it would be impossible for me to add anything of interest. In it he quotes a prominent gas engineer as stating that practically no progress had been made for 50 years in the art of meter making, and complaining of the high prices charged for them. Of course, this statement was exaggerated, since the capacities have been enlarged and other details improved; but this is all. And what need for more when it is unanimously agreed that the meter of to-day is so near perfection? The price, too, compares favorably with water and electric meters in the domestic sizes, and I honestly think, considering the skilled labor employed in making them, with the excellent material used, that they are fair value for their cost.

A number of the manufacturers are now putting on the market what they call "Large capacity meters." This violent departure has no precedence in the history of meter making. It took 60 years to increase the capacity of a 5-light from 30 to 90 feet per hour, and instead of gradually increasing the capacity as they had done hitherto the manufacturers are doubling it. Not only have they done so, but in some cases the size of the diaphragms has been decreased, thereby increasing the number of revolutions of the tangent per foot, which naturally makes a fast or slow meter more in error than one of the old type. To illustrate, we will assume a 5-light meter, with 6 revolutions to a foot, to be 5 per cent. slow. If we substitute smaller diaphragms, requiring 8 revolutions to a foot, the error will be $6\frac{2}{3}$ per cent., or an increase in error of $33\frac{1}{3}$ per cent. It certainly is tempting to the manager to be able to buy a 5-light with more capacity than a 10-light, at a 5-light price, but the question is, will this meter give the service that the old type has given? Experience has taught gas men to be to a certain extent conservative, so they will make these meters prove their worth before accepting their capacities as a standard of what a meter of a given size should be.

It seems to me that, next to the actual manufacture of gas, the meter should be of most importance; but, as a rule, especially in the smaller companies, it is given little thought. They are handled carelessly, set indifferently, and then left for years, unless there is a positive call for change or removal or until the consumer's bill falls almost to nothing. Then the company wakes to the fact that something might be wrong with the meter, and it is changed, only to find that the consumer has been getting all, or nearly all, his gas for nothing. It takes a long while for a meter to reach this condition, and how long it had been passing a certain amount of unregistered gas it is impossible to determine. A new meter is installed and, to the consumer's horror, the next bill is a large one. He naturally thinks the new meter fast, and frequently accuses the company of having adjusted the meter to run fast. Not only has the company lost revenue, but frequently a friend as well. Every manager knows that a percentage of his customers pay their gas bills under protest, fully believing they are being robbed, although they will pay their grocer, butcher and druggist without once questioning the bills or the value received.

It is a common impression with consumers that if a meter is leaking they pay for all the lost gas. This is not so unless the leak is in the outlet pipe. The loss is entirely the company's. When the leak is beyond the meter outlet the leakage is fairly constant, except when gas is being consumed, then the loss to consumer is in inverse proportion to the amount being used. For experiment, a hole $\frac{1}{16}$ of an inch in diameter was drilled in the bottom of a 5-light meter, and the loss of gas (with the outlet closed) was found to be $6\frac{1}{2}$ feet per hour, at 25–10 pressure. Gas was then passed through the meter at 5 different rates of consumption, being about the different rates an ordinary consumer would use. It was found that the smaller the rate used the larger the loss to the consumer; the average amount of loss was 12 per cent. This might serve as a rough guide in adjusting a high bill when a meter is found leaking, as I find leaks in bottom average about the size given. To keep a meter up to the standard it should be periodically tested and overhauled. Gas companies vary in the length of this period from 18 months to 7 years, but personally I think 3 years should be the limit.

A meter when brought into the shop should not only be proved but should pass through a strict examination. I have found many meters showing nearly correct on the prover that would pass 2 and 3 feet per hour without registering, and a great many that passed a smaller amount. To determine whether a meter passes unregistered gas or not we put it under the slow or pilot test. This test, though very simple, is very important and its adoption will show the manager where a large percentage of his unaccounted-for gas has gone. We use a row of rubber hose gas connections, placed about 18 inches apart, and at a convenient height from the bench. The meter after being proved is connected at the inlet to one of these rubler hose connections, and at the outlet to a burner with the gas turned so low that you can see no yellow flame. The position of the test hand on the index is then marked. If after about 3 hours the hand shows no sign of having moved, then we know there is a leak inside, probably in the diaphragms. This meter should be set aside for repairs. If the hand has been moved then it should be tried on the burner test. For this test the inlet is connected to a gas opening by rubber hose, the outlet being connected to another hose leading to a bank of burners that will take care of the full capacity of the meter under test. If the lights burn unsteadily we know that probably the valves are sticking. In that case the top and backplate should be removed and the valves cleaned. If the lights burn steadily the meter passes to the test for leaks. For this purpose we use a tank-and-bell, suspended from the ceiling, to allow the bell to be filled with gas from the regular street pressure. We test at a pressure of 14 inches of water and have a bottle leak director. The meter is connected by rubber hose to a 1-inch pipe leading from the tank, a cock being provided to turn the pressure on or off. Between this and the hose another cock is placed, and at either side of this cock is a $\frac{3}{8}$-inch connection from which pipes run to a bottle placed in a convenient position, on a level with the eyes, over the meter being tested. The bottle is pint size, with a screw, air-tight metal cap, holes being made in this cap for the $\frac{3}{8}$-inch pipes to be soldered in. The pipe connection nearest to the tank reaches half way down the bottle and the other about an inch. The bottle is filled with water to $\frac{1}{4}$ inch above the end of the lower pipe. The meter to be tested is connected at the inlet to the rubber hose and a cap screwed down tight over the outlet, the pressure is turned on and the center cock closed. If the meter leaks, bubbles of gas will rise from the pipe beneath the water, the reason being that, before the center cock is turned off, the pressure is equal in meter, pipes and bottle above the water. When the cock is shut and the meter is leaking it follows that the pressure on top of the water is not equal to that in the pipe extending below the water level in the bottle, so bubbles of gas rise to the surface. This test is so sensitive that it is next to impossible for a meter to leave the shop leaking. The whole apparatus is so simple that a gas fitter and a local tinsmith can make and fit it up. A meter after passing these tests is repainted and returned to stock.

The next type of repair is a meter which proves incorrect. If it is more than 7 per cent. slow on the check it is put aside to be thoroughly overhauled; if less, the top is taken off and the meter is put on the slow test, the position of the tangent being marked instead of the test hand. If the tangent fails to make a complete revolution in about 2 hours the meter needs repairing and is set aside. If it passes this test then it is tested for lights and leaks before adjusting.

In operating the prover for proving and adjusting it is necessary for correct tests to have both water and air of the same temperature. Means should be provided for raising the temperature of the water when necessary. We use a live steam pipe running down inside between tank and bell for this purpose. Care should also be taken to see that the proving machine is not leaking and that the running parts are kept well oiled.

In adjusting meters it is necessary to melt the solder holding the tangent to the crank, when desiring to alter the tangent's position, in order to make the open and check tests agree, then, either by lengthening or shortening the throw of the tangent, make the meter either faster or slower. This is an easier matter to describe than to put into practice, as it is an operation which requires a certain amount of skill and a good deal of patience. This work should certainly not be entrusted to anyone but a skilled workman.

A meter which is not sensitive to slight changes of the tangent probably needs the diaphragms oiled and should be set aside for that purpose. Care should also be taken to see that the bats on tangent are securely screwed up to the post, as a number of incorrect meters have come before my notice which only required the post to be straightened and the bats tightened to make then correct again.

We come now to a third type of repair: The meter that has failed on the slow test or, too much in error to be adjusted, is in need of thorough overhauling. A convenient number to do at one time is a dozen, as one operation can be done to the whole number at a time. This method is better and quicker than repairing each meter separately. The tops, backplates, backs and fronts are removed and the diaphragms tried for leaks. If the diaphragms are worn out they should be removed, care being taken not to damage partitions and channels; if sound they should be thoroughly reoiled, and the chan-

nels tested and partitions examined for leaks before replacing backs and fronts. Because a diaphragm leaks it is not always necessary to tear it out; the leather may be in good condition, but there is a rust hole in the disk or channel, possibly a split in the solder.

You will notice when the diaphragms are worn out the wear is nearly always where the leather has rubbed against some part of the case. It is advisable in replacing to use a diaphragm which does not touch, and increase the number of revolutions of the tangent per foot. In 5-lights we are using a regular 3-light diaphragm and increasing the teeth on the axle wheel from 12 to 16. Of course, it is necessary to test channels and partition before replacing diaphragms; if found badly rusted the meter should be condemned.

The practice of boiling meters (which have had diaphragms removed) in potash solution is a good one, but care should be taken that they are thoroughly rinsed in hot, clean water and dried before proceeding with the work. Shops not having the convenience of steam for this purpose can clean their meters with gasoline; but in this case extra precautions against fire should be taken. Meters having had the backs and fronts off, for reoiling or replacing diaphragms, should have the stuffing boxes repacked, valves reground, and the indices taken out and cleaned. The practice of adding a small piece of packing to that which is already there is a bad one, for it tends to make the meter run hard. The best packing I know is yarn soaked in a hot mixture of tallow, beeswax and oil, partly squeezed out and allowed to cool before using.

For quickly and efficiently grinding valves nothing is better than No. 1 emery cloth. A block with a perfectly flat surface, slightly larger than the seat to be ground, has a piece of this cloth securely attached to it with shellac and a heavy weight is placed on the back while drying to insure a flat surface. The seat should be ground with a reciprocating motion the length of the seat. For grinding the covers a sheet of emery cloth is attached to a piece of heavy plate glass and the covers ground on this in a circular motion. The valves should be tried for leaks before replacing backplate, and lost motion, if any, taken up in the valve arms. The meter should then be tested for leaks, slow test, etc., as described, before being finally adjusted and topped. New meters and repaired meters are so frequently damaged in transit from the shop to location of set that I cannot refrain from a word or two with reference to the handling and setting of meters. It should be constantly impressed on the fitters that a meter is a delicate instrument and needs careful handling. It should always be kept in an upright position and securely fastened in the wagon. The inlet and outlet should always be either plugged or capped. This is important as air has a certain action on the diaphragms which is not conducive to correct registration.

In the setting of meters care should be taken that they are not placed where damage is likely to occur to them. Prepay meters should be set high enough so that children cannot put things in the slot, and, of course, as far as possible, they should be protected from the weather. Every meter should have shelf or other support beneath it, as vibrations will certainly some time or other break the solder between the screws and pipes. Experience covering the testing and repairing of more than 20 makes of meters shows that they are all good and able to do their work correctly. Yet no one quite fills the bill as my idea of a gas meter. As a means of bringing out your criticism I give it to you.

We will take a 5-light, for example. This meter should have valves and channels large enough to pass 100 feet per hour, at 20-10 pressure and 5-10 loss; the angles of the stampings should not be sharp or deep, as this opens the grain of the metal exposing the iron. As the bottom usually rusts through first, it should be made from heavier stock than the other parts, 22-gauge, tinned iron being suitable for this purpose, and soldered inside as well as out at the angle between sides and bottom. I especially recommend this to the consideration of the makers, as the number of meters with leaky bottoms is out of proportion to leaks in any other part of the meter. The diaphragms should be cut from selected, full bark, tanned sheepskins and the seams sewed with stitches close together. They should not touch any part of the case, but should still be large enough to operate the tangent at 6 revolutions per foot. The flag arms should be heavy and strongly ribbed with an enlarged end to make a sweated joint with the rod. The valve arms should be of white metal, straight, strongly ribbed, and have large wearing surfaces, the stuffing boxes, large, with brass hexagonal caps, and space between the top of center box and worm to allow repacking without removing tangent, kingpost and worm. The screw should be of the flange type. In the prepay meter there should be as few working parts as possible, and these strongly constructed, the price-changing arrangement simple and easy of access. A dial showing definitely the amount of gas unconsumed would be an advantage, and so would an arrangement that closed the slot automatically after a coin had been inserted.

Discussion.

The Chairman—This excellent paper on a most important subject is before you. I will ask Mr. George Ackermann (Atlanta, Ga.) to lead the discussion.

Mr. Ackermann—I would, first of all, congratulate Mr. Leech on his paper. I had no idea of coming in contact with him and the paper until the morning before leaving Atlanta; therefore, I am not prepared to criticize it, although he asks for criticism. In his history of the meter, from Mr. McDonald, of Albany, N. Y., stated there had not been changes to amount to anything in the past half century. The Glovers, of England, are supposed to be the first manufacturers of meters in the world. A meter was originally patented by one John Dowe, as well as I remember, about the year 1834. The first dry meters were put in practical use about 1846, and were used only temporarily, being discarded for wet meters. Numbers of experiments have been made on gas meters; in fact, I suppose more than on any other one appliance or piece of machinery connected with the gas business. For instance, the American Meter Company, of New York, kept men doing nothing else than experimenting on meters for a number of years. They fitted diaphragms made from parchment paper, put into meters, and placed it on an arch top leading into their yard. It remained there for a while, and was finally thrown out. Later, they tried a flexible steel, hammered very thin, to take the place of sheepskin, without success, the latter being the only diaphragm that could well be used in the construction of a gas meter. It has to be selected with great care, for there are times, even when the skin is still on the animal passing around through woods and underbrush, a thorn may pierce the skin, and after that skin has been removed from the animal and thoroughly tanned, oiled up, mounted on the range and hung on the rods for seasoning, a fitter or a mounter has to examine it thoroughly before placing it inside of a meter. In testing diaphragms, we take these diaphragms up in each hand, hold them up between you and the flame, and turn the diaphragm around gradually until every part of the leather has been seen through, to determine whether punctures are present. Finding no hole in the leather, the seams are shellacked inside and outside. The diaphragms being made by hand, the seams are sewed, so occasionally it occurs that women, sewing the seams, let the needle project through the outer skin., thus causing a puncture. This, by being left unattended, will rapidly increase in size. As to the managers buying meters of increased capacity, where the capacity is greater in a 5A-light than in the ordinary 10-light, I believe the 5A meter is the worst proportioned meter on the market. Although the capacity of the 5A meter is 218 cubic feet per hour, the capacity of the 20-light meter is the same. The 10-A and 30A I don't find so bad; in fact, the latter proves up unusually well. Atlanta has quite a number of them. We have had 30A meters that passed more than a million feet of gas since being installed, taken out and put through the small flame test and proved up absolutely correct; the 5A doesn't prove so well. The fact of the thing is, the 5A meter is built out of proportion of any of the others. Inasmuch as the diaphragm is of reduced size, the valves are so large that gas condensing throws a moisture over seats and the covers, if the water is allowed to stand over night, or 2 or 3 days, during which it is unused, the changes in temperature draw off this deposit that is on the seats, causing them to become dry and sticky. In that case, if the meter is turned on suddenly—a number of burners or a large appliance—you are liable to burst the diaphragm in the meter, provided the meter has been in use for several years. If you only turn on one burner, the possibilities are you get gas registered without the meter working. At one point in the paper it is stated: "It seems to me, next to the actual manufacture of gas, the meter ought to be of most importance." That, I think, has always been true; and the writer says also that smaller companies seem to give this very little thought. Well, now, I would like to give you a little of my experience in that line. In 1890 I went to work for the Atlanta Company, and found conditions at the time very bad. The United Gas Improvement Company had recently (1890) assumed possession or control. In 1889 they opened a meter repair shop, and in 1890 there was only one man in the shop, who, of course, was unable to take care of all the work. When a meter was brought in from service it was read off and left in the storeroom. They put the Company number, size and index on a piece of ordinary paper, no matter of what sort, fold-

ing it in square shape, threw out the square corner, slipping it down over the screw of the meter. The fitter's helper took it up to the meter shop and set it on the floor. In a day or two, if an order came to set a meter, the order coming from the office to the shop, the fitter would tell his helper he wanted a certain sized meter. The helper immediately went to the shop, and, without asking any questions, picked up any meter on the floor. It was carried out and set, and it might register or it might be dead. The fitter at that time didn't pay any attention to it as to whether or not it registered, unless it was actually stuck; if it was actually stuck, he brought it back. Careless handling of meters should have more notice taken of it than is the case. In Atlanta, our Mr. Wimberly, foreman, distribution department, drills his men on this constantly, once or twice a week, and has done so for years. Now he has it up to where the meters are handled unusually well. About a year or so ago Mr. Wimberly asked me to visit his shop one morning and explain to his fitters just how a meter should be handled and set. I endeavored to explain to them how they should handle the meter and how it should be set to prevent complications. I told them meters should be set as nearly flat as the naked eye could determine, that the connections were used, one rigid and one leaded, possibly both rigid, that the swivels should be made to member with the screws of the meter before screwing down the caps. This will prevent any possibility of the meter screws being pulled out, provided the service pipe is properly strapped underneath the house.

[The President said that inasmuch as a meeting of the Executive Committee was on for 12 o'clock, it would be impossible to finish the discussion within the time. He, therefore, suggested an adjournment to 2 P.M., the discussion to be resumed on reassembling. He also noted that Capt. W. E. McKay, of Boston, proposed to address the members on a matter of importance, and the report on "Ventilation," by Mr. Ferrier's Committee, would be submitted. So it was important that the attendance should be prompt.]

(To be Continued.)

Opportunities of the Clerk.[1]

[By MR. H. S. DUTTON, Chief Clerk, West Chester, Pa., U. G. I. Co.]

I know of no other employee of a gas company to day who has a greater opportunity to assist all branches of the business, and at the same time develop himself into a practical gas man, than the clerk in the office of a gas company in a small city. If live, energetic and up-to-date, he can grasp the opportunities offered for insight into all the branches of the business, which will be a great aid to him.

On entering into this business, the clerk must first learn to be courteous and obliging, meeting everyone with a pleasant word. It matters not what nationality or color they may be, to gain the confidence of the people is his object and should be his duty.

I personally believe we, as chief clerks, should make it a point to know all our consumers, and be able to call them by name, as cordiality goes a great way towards making them friends; and this is particularly what the gas company needs to-day to help keep down com plaints and expenses.

In an office, where there are possibly two clerks besides yourself, it is necessary to help take care of the ledger, meter records, com plaints, act as cashier, sell appliances when necessary, and many times go out on a hurry-up complaint; in fact, do almost anything that pertains to the business. It is possible to get many points that will help the new business department. For instance, a consumer comes into the office to pay a small gas bill. You can inquire in a pleasant way if she or he is using certain appliances, and in this way you can often hand your new business man a memorandum to send a solicitor to call on a prospect.

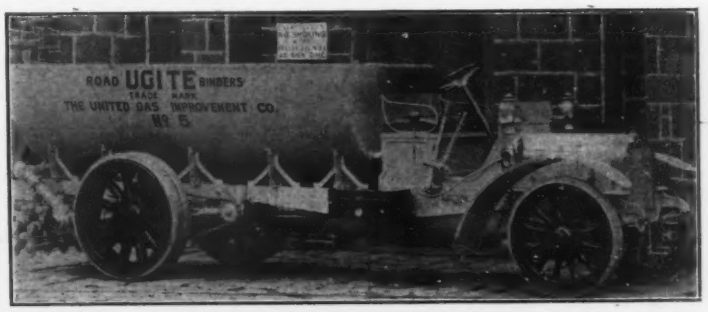
Many of the callers are newly married people, or persons who never use gas, and by asking a few questions you can obtain information which, when handed to the new business department, will prevent these people from installing some other kind of cooking or lighting appliances.

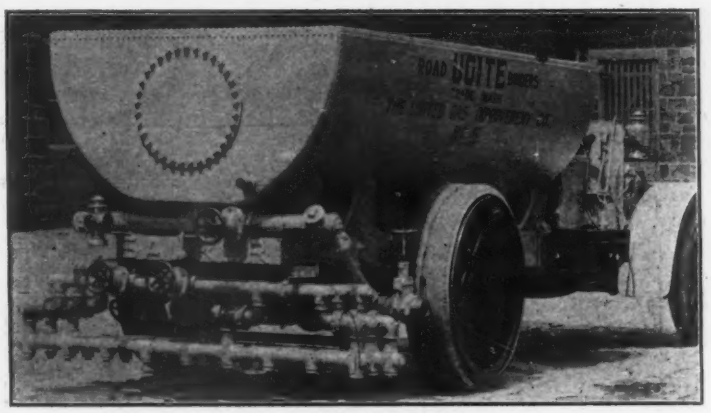
Look after the company's interests at all all times, whether in or out of the office. By this I do not mean to "take your work home with you," but I do mean that when you are on the street, at a social gathering, or in the store where you are dealing, always keep an eye and ear open for new business or trouble you may hear of that will affect the company, and report these things to the p roper department. Thus as you are looking after the business, so you r manager is looking out for you, for he will see that you are not only developing yourself into a better business man, but are also lookin g after your company's interests. By so doing you may not a lways remain in the small city—at least, in the capacity of clerk.

1, "New Business."

Management & Commercial Methods.

THE UGITE SPREADER TRUCK.—The picture shows a truck for spreading, under pressure, bituminous binder on roads. The capacity of truck is 5 tons of binder, which is distributed o n the roads at a uni-





form rate per square yard, regardless of the speed of the machine. The design of the truck adapts it for travelling on steam boats and cars. The distributing apparatus is so simple as to require no descriptive lines.

A CALIFORNIA PICNIC.—Dear JOURNAL: I thought possibly that you might be interested in having a line or two respecting the Third Annual Picnic of the Los Angeles (Cal.) Gas and Electric Corporation, which was brought off at the beautiful ranch, formerly the property of the late "Lucky" Baldwin, one beautiful day of recent date. Over 3,600 men, women and children shared the festivities, and 44 special cars were required to carry them to the Ranch, which rejoices in the title of Arcadia. The start was made at 9 A.M., and the park was quiet at 8 P.M. The games that were played, the tricks that were turned, the things that were done, left not a slow moment in the hours given over to festivity. Of course, the real sporting event of the day that was enacted was the game of baseball, between representatives of the office and mechanical divisions. The contest

"May Queen."

was for a handsome silver trophy, presented by President Walter B. Cline, and it was won by the office 9 (score, 3 to 2), although the result would likely have been different were it not for the peculiar umpiring of G. W. Gibson. It did rain some, but that made no difference. The women folks also did some surprising stunts, not the least amazing of which was the left footed football booting, done by Miss Louise Gebbert, who was an admirable second to the right-footed booter, Miss Bertie Duggan. A tug-of-war showed how strong the electric division was in the matter of wire pulling. The electricians just simply toyed with their opponents. The other events were almost numberless. The children also had a full number of sporting events, and we reproduce the Queen of the May and her court in the accompanying picture. Swings, clowns, burros, teeters, dancing, etc., kept the youngsters busy every minute. Eatables and drinkables were available at all times, and that the edibles were freely put away may be judged when it is said that these things were used up during the formal luncheon sitting: 17,000 sandwiches, 7,200 eggs, 150 gallons ice cream, and a score of other edibles.

Recent Patent Issues.

Prepared for the AMERICAN GAS LIGHT JOURNAL by ROYAL E. BURNHAM, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,030,080. Outside Lamp for Inverted Incandescent Gas Light. H. Graetz, Berlin, Germany.

1,030,082. Lamp. J. Grantz, Chicago, Ills., assignor to The Naegel-Chase Manufacturing Company, same place.

1,030,118. Gas Burner. C. O'Neil, Point Marion, Pa., assignor of one-half to J. W. Evans, same place.

1,030,202. Furnace for Gas Generators. F. J. Orr, Buffalo, N. Y.

1,030,332. Manufacture of Carbureted Water Gas. J. M. Rusby, Philadelphia, Pa., assignor to the United Gas Improvement Company, same place.

1,030,333. Distillation of Bituminous Coal and the Like. J. M. Rusby and O. B. Evans, Philadelphia, Pa., assignors to the United Gas Improvement Company, same place.

1,030,341. Cut-off for Gas Pipes. J. J. Staley, Dayton, O.

1,030,911. Automatic Check Valve for Inflammable Gases. H. B. Migliavacca, Napa, Cal.

1,030,954. Protective Container for Mantles. M. C. Whitaker, Gloucester City, N. J., assignor to Welsbach Light Company, same place.

1,030,967. Gas Regulator. F. C. Blanchard and E. B. Crocker, Bridgeport, Conn., assignors to the Ashcroft Manufacturing Company, same place.

1,031,012. Globe Holder for Lamps. T. J. Little, Jr., Woodbury, N. J., assignor to Welsbach Light Company, Gloucester City, N.J.

1,031,013. Incandescent Gas Lamp. T. J. Little, Jr., Woodbury, N.J., assignor to Welsbach Light Company, Gloucester City, N. J,

1,031,014. Incandescent Lamp. T. J. Little, Jr., Woodbury, N. J., assignor to Welsbach Light Company, Gloucester City, N. J.

1,031,017. Economic Process of Producing Gas. M. Mauran, Niagara Falls, and J. H. MacMahon, La Salle, N. Y.

1,031,128. Incandescent Gas Lamp. T. J. Little, Jr., Woodbury, N.J., assignor to Welsbach Light Company, Gloucester City, N. J.

1,031,219. Protective Container for Mantles. M. C. Whitaker, Gloucester City, N.J., assignor to Welsbach Light Company, same place.

1,031,224. Automatic Gas Cut Off. J. Zaphiriadis, Lowell, Mass.

1,031,606. Method of Heating Vertical Gas Retorts. H. W. Woodall, county of Dorset, and A. McD. Duckham, county of Surrey, England.

Items of Interest
FROM VARIOUS LOCALITIES.

THE Lloyd Construction Company, has been authorized to construct for the South Framingham (Mass.) Gas Company a 15-inch governor to be installed forthwith.

MRS. CATHERINE OVERSTREET, widow of the late Congressman Jesse Overstreet, was united in marriage to Mr. Carl Herman Graf, Vice-President and General Manager, Indianapolis (Ind.) Gas Company, the evening of June 27th. The ceremony was performed at the residence of the bride's parents (Mr. and Mrs. Francis Thomas Crump) in Columbus, Ind., the Reverend Mr. Sharp, of the Presbyterian Church officiating. They will be at home, in "The Wordsworth," Indianapolis, after September 15th. This news is in the nature of a pleasurable surprise, and if every pair that enter the matrimonial pact were as seemingly fitted for partnership as are the persons mentioned, then indeed would their future companionship be one of harmonious helpfulness. Mrs. Graf, in her bellehood days (and those are far from being all tallied) was known through Ohio, Indiana, Kentucky and Tennessee for her beauty, tact and graciousness, and her husband also surely is well known, and well liked throughout the gas industry, for his value as an engineer and his worth as a man, so why should they not forever happy be.—C."

THE United States Military Academy, at West Point, N. Y., seems to be at last (that is, as far as the choice of a fuel agent is concerned) in the hands of a modern manager. We judge this from the fact that Messrs. Waldo, of Boston, are installing on the grounds 2 benches of 6's, that are to be in operation by September 15th.

MR. NELSON A. GREENE, for 50 years in the service of the Providence (R. I.) Gas Company, died at his home in Providence, R. I., the afternoon of Friday, June 28th. Deceased entered the services of the Providence Company in March, 1862, as a meter reader, his first assignment being given him by the late Col. James H. Armington, then Superintendent at Providence. Two years later he was given the position of head teamster and in that capacity he served until his death. Big of body, jovial in disposition, honest to the final degree, his life was that of a man who, while faithful to his employers, was just with his men. The funeral services were held in his late home, Bullock's Point avenue, Riverside, the afternoon of July 1st, the Rev. Frank Louis Bristol officiating. His widow survives him, also a son and daughter.

MR. F. R. FORD, writing from Dayton, O., the morning of July 6th, says: "Dear JOURNAL: I'm just home for a long trip abroad, and on looking over my JOURNALS, more particularly those for the last 3 months, I find no mention of the death of General William P. Orr, who died at his home in Piqua, O., the evening of May 23. As in his time he had been closely identified with the gas industry of Ohio, I'm sure you will agree with me that the final record should contain some mention of a man who was an ornament to his position, and whose long public career, without a smirch or taint, made him well known and admired by the people of his native State. Born in Piqua, O., March 26th, 1842, his business life (which really dates from 1862) was one of unbroken success. Beginning in the hardware business he gradually advanced in the commercial world, and much of the growth of Piqua is traceable to his efforts. As was the case with many other sturdy youngsters he enlisted in an Ohio regiment, which served at the front, and his acts in this line were sufficiently meritorious to bring him rapid advancement, until some years ago, by brevet, he was awarded the title of General. At the close of the war he engaged in mercantile trading, and his interests in many things naturally caused his accumulation of quite some stock in the Dayton Gas Light and Coke Company. By this corporation he was eventually chosen President, and served it as such for several terms. He also virtually owned the Piqua Gas Company at one time, and was one of the organizers of the Miami (O.) Gas and Fuel Company (natural gas), and was largely interested in it at the time of his death. He was a brother-in-law of the late General Calvin Brice, and is survived by 1 son. The funeral services were held the afternoon of Sunday, June 30th, in the Piqua Presbyterian Church, the Rev. John Montgomery officiating. Interment was made in Forest Hill Cemetery.

THE organization of the United Gas and Electric Corporation was completed the 1st inst., by the naming of the following executive management: Directors, R. E. Griscom, Jno. Gribbel, R. L. Montgomery, G. E. Shaw, F. M. Potts, S. R. Bertron, George Bullock, Henry Morgan, H. Bronner, M. W. Dodge, S. J. Dill, Saml. Insull, S. C. Dunham, W. W. Griest and John S. Jenks, Jr.; President, George Bullock; Vice-Presidents, R. E. Griscom and S. J. Dill; Secretary and Treasurer, Henry Morgan; Asst. Sec. and Treas., M. D. Evans. The Securities of the new Company are now being issued in exchange for those of the Corporation taken over.

THE surprise of the day (and the night as well) at Monmouth, Ills., is the chartering of the Monmouth (Ills.) Gas and Electric Company

to maintain and operate a gas and electric plant in the place named. The incorporators are Messrs. John Haron, Oscar E. Mertz and E. P. Seibt. Our informant adds: "The scheme is capitalized in $10,000, and the appearance of this bunch is unheralded; further, they are unknown here or hereabouts. If it is an opposition concern they'll get scant measure in this vicinity."

"BEAUTIFUL DETROIT" is seemingly becoming anxious to gain a qualifying title; and it occurs to us this anxiety, if appeased, will result in the appellation being changed to something like this: "Beautiful, but close!" However, some evenings ago, at a special meeting held between closed doors, the Janitors and Supplie's Committee, of the Board of Education, determined to recommend to the Board that hereafter school teachers be forbidden to use gas paid for by the city to prepare meals for themselves in the schools. It was alleged that teachers also used food purchased for the domestic science departments in the schools for their lunches. A man named Goldberg is Chairman of the Committee, and that means something.

THROUGH an agreement signed by 16 citizens of Excelsior, Minn., the town is guaranteed a continuation of the Excelsior Gas Company's trading for a period of 2 years. It is agreed that the rate may be put at $2.50 per 1,000 cubic feet, instead of $1.75, which rate was an incumbent one established by the authorities. The plant will be operated by a committee of citizens composed of Messrs. F. P. Lane, L. F. Sampson, Frank Bardwell and W. S. Loudon. Mr. Wheeler, the former owner of the plant, declares that he is "through with it!"

MAYOR GEORGE W. SMITH seems to have the right sort of grit in him. At any rate the night of the 2d inst., Town Clerk, A. G. Boettinger, sent a lengthy communication from the executive, vetoing the recent ordinance adopted by Council which granted life to the newly organized Hackettstown (N.J.) Gas Company. The Mayor objected to many clauses of the ordinance, alleging lack of obligation by the Company to the town, also naming legal defects. His main contention, however, was the proposed length of life of the franchise, which was put at 50 years.

THE Finance Commission, of Boston, recently submitted a report to Mayor Fitzgerald, recommending that the city immediately make a contract for the purchase and installation of inverted lamps of the Graetzin type, to replace the lamps at present used for lighting streets. The Commission also recommended the purchase by the city of 2,000 automatic lighting and extinguishing devices and declared that the 8,000 (plus) other street gas lamps be equipped with such apparatus as quickly as possible.

ADVICES by way of Salt Lake City, Utah, dated July 1st, are to the effect that Messrs. Williams, McConnell & Coleman, of New York, announce the absorption of the Utah Gas and Coke Company, of Salt Lake City, by the American Utilities Company, a corporation organized under the laws of Delaware. The concern is capitalized in $40,000,000, one-half of which is preferred stock, 6 per cent. interest (cumulative), preferred both as to dividends and assets; and ½ in common stock. The principals in interest are Messrs C. B. Kelsey and J. H. Brewer, of Grand Rapids, Mich., who, under the name of Kelsey, Brewer & Co., control the shares of the following named Companies: Utah Gas and Coke, Salt Lake City, Boise (Idaho) Gas Light and Coke; Valparaiso (Ind.) Lighting Co.; Elkhart (Ind.) Gas and Fuel; Winona (Minn.) Gas Light and Coke; Holland City (Mich.) Gas; Jackson (Miss.) Light and Traction; Albion (Mich.) Gas Light; and the Minnesota-Wisconsin Power. In order to secure $725,000 in cash to be used for corporate purposes, the Company will offer for sale at par preferred stock in the amount named, plus a bonus of 40 per cent. in common stock. Manager J. C. D. Clark (who succeeded Mr. J. C. Ross in April last) of the Utah Gas and Coke Company when spoken to respecting the matter of the change said: "This consolidation, which will without doubt, be successfully consummated as planned, means much to Salt Lake City. It means a great strengthening of the local Company and will afford the opportunity for the acquisition of funds with which to greatly improve the local plant and largely extend our service. We are now serving about 7,500 customers; we ought to be serving 30,000 in a city of this size. If every home used gas the smoke nuisance would be abated by more than 50 per cent. There will be no changes in the management of the local plant, but the consolidation will enable us to have the benefit of the best talent in the gas world, for the Consolidated Company will have a traveling engineer, the best that money can procure, who will visit the different plants, keep in touch with every late improvement and scientific development and offer suggestions that will be carried out." Messrs. Kelsey and Brewer, and Chief Engineer S. C. Schaffner will be in Salt Lake this week to inspect the properties for proper determining as to the nature and quantities of construction work necessary to put the plant up to the point of meeting the greatly increased demands that certainly will be made on it.

MR. CHARLES H. LANPHIER has been appointed Inspector of Gas and Meters for Illinois, with headquarters in Springfield.

THE Minneapolis (Minn.) Gas Light Company's executives have determined upon a sensible addition to its plant which comprises 2 steel coke bins and screening tower, to be erected on the plot at Bluff street and 19th avenue, South. The Minneapolis Steel and Machinery Company will build the addition.

MR. J. S. SMALL (a graduate of Purdue University, and well-known in mechanical electric circles for several years) has purchased ½ interest in the Gas and Electric Company, of Ottawa, Kas., the other half being the property of Mr. I. W. King. He will remove to Ottawa, and will actively assume the superintendency of the combined properties.

"B. V. W.," writing to us from Palatine Bridge, N. Y., under date of the 5th inst., incloses the following: "Mr. H. B. Bryans, since 1909 on the engineering staff of the Fulton County (N. Y.) Gas and Electric Company, will in a few days remove to Philadelphia, where he will assume the post of Chief Assistant to the Inspector of Tests, with headquarters in the home office of the U. G. I. Company. His successor is Mr. Louis C. Smith, a graduate of the University of Pennsylvania, Class of 1907."

LICENSE has been granted to the Consolidated Gas, Electric Light and Power Company, of Baltimore, Md., to construct a brass finishing shop, at the corner of Carey and Wicomico streets. Its diminsions are 118 by 115 feet, one story high. The Company will also construct a machine shop at Carey and Severn streets.

PUBLIC LIGHTING TABLE FOR JULY, 1912.

[COMMUNICATED BY THE AMERICAN METER COMPANY.]

Day of Week.	MOONLIGHT SCHEDULE.		
	Date.	Light.	Extinguish.
Monday	1	8.00 P.M.	10.30 P.M.
Tuesday	2	8.00	11.00
Wednesday	3	8.00	11.20
Thursday	4	8.00	11.40
Friday	5	8.00	12.00
Saturday	6	8.00	12.20 A.M.
Sunday	7	8.00 L.Q.	12.50
Monday	8	8.00	1.10
Tuesday	9	8.00	1.40
Wednesday	10	8.00	3.40
Thursday	11	8.00	3.40
Friday	12	8.00	3.40
Saturday	13	8.00 N.M.	3.40
Sunday	14	8.00	3.40
Monday	15	8.00	3.40
Tuesday	16	8.00	3.40
Wednesday	17	8.00	3.40
Thursday	18	9.20	3.40
Friday	19	9.40	3.40
Saturday	20	10.00 F.Q.	3.40
Sunday	21	10.30	3.50
Monday	22	11.00	3.50
Tuesday	23	11.30	3.50
Wednesday	24	12.10 A.M.	3.50
Thursday	25	1.00	3.50
Friday	26	2.00	3.50
Saturday	27	No L.	No L.
Sunday	28	No L. F.M.	No L.
Monday	29	No L.	No L.
Tuesday	30	7.50 P.M.	9.30 P.M.
Wednesday	31	7.50	9.50

The Market for Gas Securities.

The feature of the week was the coming into their own by the shareholders of the New York Mutual Gas Light Company. On Tuesday the Company declared a dividend of 2.4 per cent., to be added to the dividends paid for each of the 5 years previous to December 31, 1910. This brings the return up to the rate paid by the Company prior to the institution by the State of the 80-cent gas charge. This, of course, virtually puts the Company on a 9 per cent. basis, and one can well afford to point with satisfaction to the clever manner in which this sterling branch of the Consolidated is managed.

Consolidated held its own virtually last week although the trading in the shares was very light. The opening to-day (Friday) was made at 143 to 143¼. Brooklyn Union shows no change, but we have an idea that action respecting a readjustment of its capital account, which may be started next month, will put this stock well beyond the 200 mark. Peoples, of Chicago, is slated for a rise, which seems to be close at hand, judging from a sharp advance in it towards the close of the week.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

JULY 15.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$73,177,000	100	143	143⅛
Central Union Gas Co.—				
1st 5's, due 1927, J. & J.	8,000,000	1,000	103	105
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	8,500,000	100	190	245
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	101	102½
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	96	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	109
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	143	144
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	299,650	500	180	—
Out-of-Town Companies.				
Bay State	50,000,000	50	⅛	⅜
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	509,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric Co.	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. & Heating Co.	1,682,750	100	90½	91
Preferred	3,026,500	100	75½	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	13,460,084	—		—
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½	10,061,000	—		—
Con. Gas Co., Baltimore City, 4½	2,751,000	—		—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,580,000	—	—	50
Detroit Gas Co., 5's	881,000	1,000	75	80
" Prior Lien 5's	5,619,000	1,000	97	100½
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	183	186
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	-
Grand Rapids Gas Light Co., 1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	—	130	188
" Bonds, 5's	10,500,000	—	101	106
Indianapolis	2,000,000	—	—	38
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	91	95
Kansas City Gas Light Co., of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	99	102
Laclede Gas Co., St. Louis.	10,000,000	100	106½	107
Preferred	2,500,006	100	90	91½
Bonds	10,000,000	1,000	102¾	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	
Massachusetts Gas Companies, of Boston	25,000,000	100	89	90
Preferred	25,000,000	100	96	98
Montreal Gas Co., Canada	2,000,000	100	216	220
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	5,000,000	25	182	190
Peoples Gas Lt. & Coke Co., Chicago	25,000,000	100	115½	116
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
Pacific Gas and Electric Co.	15,500,000	—	64½	65½
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	98
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	106
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
Washington (D. C.) Gas Co.	1,600,000	200	420	425
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 16 to 18, 1912. Marlborough-Blenheim Hotel, Atlantic City, N. J. Officers: President, Ira C. Copley, Aurora, Ills. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting and Gas Show, Toronto, Aug. 26th to Sept. 7, 1912. Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 1912. Officers: President, R. M. Searle, Rochester, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Gas Meters.—Monthly meetings. Chairman, Will W. Barnes; Commissioners, W. H. Pettes, I. W. Peffly; Secretary, H. Thurston Owens, 42 Pine street, New York City.

Guild of Gas Managers of New England.—Annual meeting, March, 1913. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 19th and 20th, 1913. Chicago, Ills. Officers: President, H. O. Channon, Quincy, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting, Niagara Falls, Canada, Sept. 16-19, 1912. Meetings of Sections, monthly. Pres't, V. R. Lansingh, New York City; Secretary, Preston S. Millar, 29 W. 39th street, N. Y. City. Sections: New York, Secretary, C. L. Law, 124 West 42d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. B. Jackson, 28 North Market street. Pittsburgh, Secretary, J. C Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March, 1913. Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, Burlington, Ia., May, 1913; Officers: President, C. W. Fair, Atlantic, Ia.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October 17-19. Manhattan, Kas. Officers: President, B. F. Eyer, Manhattan, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association.—Annual meeting, September 4-6, 1912; Toronto, Canada. Officers: President, F. W. Blowers, Kalamazoo, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1913; Joplin, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting and Gas Show, Dec. 2-5, 1912. Atlanta, Ga. Officers: President, C. L. Holman, St. Louis, Mo.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, Cleveland, O., May, 1913; Officers: President, M. B. Daly, Cleveland, O; Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, ——— 1913. Boston. Officers: President, D. D. Barnum, Worcester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Summer Meeting. August 24, Atlantic City, N. J.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn Belmar, N. J.

Ohio Gas Association.—Annual meeting, February ———, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, May, 1913. President, Noel R. Gascho, Alva, Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, San Diego, Cal., September 17, 18, 19, 1912. Officers: President, W. Baurhyte, Los Angeles, Cal.; Vice President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, John A. Britton, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, York, Pa., April, 1913; Officers, President, H. H. Ganser, Norristown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 13, 1912; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, April ——— 1913, Charlotte, N. C. Officers: President, C. E. White, Montgomery, Ala.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. April———1913, Galveston, Tex. Officers: President, F. M. Lege, Jr., Galveston, Tex.; Secretary, H. S. Cooper, Galveston, Tex.

Wisconsin Gas Association.—Annual meeting, May ——— 1913, Milwaukee, Wis. Officers: President, I. F. Wortendyke, Janesville, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.